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Influence of tempromandibular joint disorders on Bennett angle and horizontal condylar inclination measurements determined by cadiax compact II in patients with TMJ disorders

A thesis

Submitted to Council of the College of Dentistry Baghdad University in partial fulfillment of the Requirements for the Degree of Philosophy in Oral Medicine

By

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بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

﴿ يُؤتِي الْحِكْمَةَ مَن يَشَاء وَمَن يُؤْتَ الْحِكْمَةَ فَقَدْ أُوتِيَ خَيْرًا كَثِيرًا وَمَا يَذَّكَّرُ إِلاَّ أُوْلُواْ الأَلْبَابِ ﴾

صَدَقَ اللّهُ الْعَظِيم

سورة البقرة ***(269)***

Declaration

I certify that this thesis was prepared under my supervision at the University of Baghdad in partial fulfillment of the requirements for the degree of philosophy in oral medicine

Signature

Professor

Dr. Fawaz Dawood Al-Aswad

Dedication

To:

Soul of My Father and Dearest My Mother

To:

All My Family

I dedicate this work

Hamzah

Acknowledgment

Thanks to **ALLAH** for inspiring me with energy and strength to finish my work.

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Abstract

Background:

The "temporal mandibular joint" (TMJ) is the synovial joint. That connects the jaw to the cranium. These two joints, are situated just, in front of each ear. Each joint is composed of the "condyle of the mandible", "an articulating disk", and the "articular tubercle" of the temporal bone. The movements permitted are "side to side", "up and down", as well as "protrusion and retrusion". This complex joint, beside with its attached muscles, allows movements, needed for (speaking, chewing, and making facial expressions). Pain and functional disturbances, related to the joint are common however; there is no broadly accepted, "standard test" now available to properly diagnose the TMJ disorders. Because the "exact causes and symptoms" are not clear, recognizing these disorders can be "difficult and confusing".

Aims of the study:

Measurement of "horizontal condylar inclination" and "Bennett angle" in patients with TMJ disorders using cadiax compact II, and compare the value of "Bennett angle" and "horizontal condylar angle" with TMJ disorders with different etiological factors whether myogenic, arthrogenic, headache attributed to TMJ, intraarticular joint disorders and degenerative joint disorders with control group.

Correlation the values of "horizontal condylar inclination" and "Bennett angle" with CT and MRI finding in patients with degenerative joint disease and intraarticular disorder respectively.

Subjects, materials and methods:

The case control study conducted in "College of dentistry Baghdad University". Patient’s age, range from 25-55 years old. Moreover, all patients acknowledged about the study, and informed consent obtained. The study sample, consist of "one hundred patients" with TMJ disorder and twenty control group.

Patients with TMJ disorder, distributed into five groups according to, Diagnostic Criteria for Temporomandibular Disorders 2013. The values of "horizontal condylar inclination" and "Bennett angle" obtained using Cadiax Compact II for patients and control groups.

Results:

From 100 patients with TMD 44 male and 56 female and 20 control group, 10 male and 10 female, age range from 25 to 55 years divided in to three age group (25-/35- /45-55) years. Significant relation established between disordered group and control regarding maximum and assisted mouth opening and excursive movements of mandible compared to control group. MRI findings for intraarticular disc disorder group showed 60% of patients had normal disc position in closed mouth, and 40% had anterior disc displacement. CT scan for degenerative joint disease disorder group showed that 45% of patients had flattening, 25% had space narrowing, 10% of patients had subchondral thickening, 10% had osteophyte formation and 10% had erosion. Result showed significant lower mean value of horizontal condylar inclination compared for control group, and lower mean value for Bennett angle of disordered group compared to control group with significant relation for left joints of myofascial and headache group.

Conclusions:

The "Horizontal condylar inclination" values for degenerative joint disease, arthralgia, myofascial, headache attributed to TMJ and intraarticular disc disorder patients significantly lower than control group therefore this parameter could be use in diagnosis of joint disorder. The "Bennett angle" mean value for degenerative joint disease, arthralgia, myofascial, headache attributed to TMJ and intraarticular disc disorder patients lower than control group and statistically significantly in left joints in myofascial and headache group and might use as preliminary detector. No significant relation had established between MRI and

CT image findings for intraarticular disc disorder and degenerative joint disorder groups regarding "Horizontal condylar inclination" and "Bennett angle".

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Abbreviation	Meaning
AAOP	American academy of orofacial pain
ADD	Anterior disc displacement
IADD	Intraarticular disc disorder
IADDIL	Intraarticular disc disorder with intermittent locking
I.U	Intrauterine life
CT	Computerized tomography
HCI	Horizontal condylar inclination
MRI	Magnetic resonance image
OPG	Orthopantomogram
TCI	Transverse condylar inclination
THA	Transverse horizontal axis
TMDs	Tempromandibular joint disorders
TMJ	Tempromandibular joint
TML	Tempromandibular ligament

Introduction

Temporomandibular disorders comprise of a group of pathologies affecting the masticatory muscles, the temporomandibular joint, and the related structures. The "Temporomandibular disorders" constitute a major, public health problem, as they were one of the chief sources of "chronic orofacial pain" interfering with daily activities. These disorders also were commonly associated, with other symptoms, involving the head and neck region, such as "headache, ear-related symptoms", "cervical spine dysfunction", and "altered head and cervical posture" (Susan Armijo-Olivo, *et al*., 2016).

The Diagnosis of "TMJ disorders" is not always, straightforward. The problems can affected the bones, ligaments, connective tissue, muscles or teeth. Many of the "TMJ symptoms" can also be caused, by other health issues. The mandibular joint due to their complex structure and function, occasionally require a broader range of analytic methods including those, enable the recording and picturing "individual mandibular movements" (Anna Sójka *et al*., 2015).

The "American Academy of Orofacial Pain" (AAOP); has classified TMD into two main groups: muscle and joint pain .It's expected that temporomandibular joint disorders, affect roughly 30% of the general population in asymptomatic form (Leeuw R., 2010).

The "tempromandibular joint" problems were widespread, affecting (90%) of the general population, at one life stage or another, especially 20-40 year-old. However, only (10%) of affected individuals seeking treatment for pain, and, less often, for articular noises (Olivier Laplanche *et al*., 2012).

The "masticatory system" is, however, dynamic, and the main component, lies in the mandible. The "mandibular movement" executed by TMJ is a motor functional movement, that reflects the status of all mandibular joint components, the Jaw recording of the system has used by gnathologists, for the understanding of the normal function of the "stomatognathic system" and for the diagnosis and treatment of diseases of TMJs, such as the temporomandibular disorders (Nakata M., 1998).

Historically, "mechanical pantographic tracings" used to record mandibular border movements, and to set an adjustable articulator prior to "prosthetic reconstruction". Mechanical pantographs, no longer produced. The "computerized pantograph" has replaced the "mechanical pantograph" as the recording device for recording the border movements of mandible (Richard R. Dryer, 2014).

In the recent years, many researchers emphasize the importance, of electronic pantograph in differential diagnostics of "mastication organ dysfunctions", due to precision and accuracy of the measurement data obtained (Edward Kijak, *et al*., 2015 and Sójka A *et al*., 2017).

Cadiax compact II device from "Gamma Medizinisch-wissenschaftliche Fortbildungs" used in this study to determine alteration of condylar and Bennett angle for "tempromandibular joint disorder patients" compared to control group.

Aims of study

1- Determination of mandibular border movement including mouth maximum opening, mediotrusion left and right and protrusive movement for TMD patients and compare to control.
2- Measurement of Bennett angle and horizontal condylar angle in patients with TMJ disorders using cadiax compact II.
3- Correlation the value of Bennett angle and horizontal condylar angle with CT and MRI finding in patients with degenerative joint disease and intraarticular disorder respectively.
4- Correlation the value of Bennett angle and horizontal condylar angle with TMJ disorders with different etiological factors whether myogenic, arthrogenic, headache attributed to TMJ, intraarticular joint disorders and degenerative joint disorders to establish base line information for a criteria for TMJ diagnosis in Iraqi patients.

1. Tempromandibular joint

The "temporomandibular joint" (TMJ) was the articulation between the squamous part of the temporal bone and the mandibular condyle; it was a complex, sensitive, and highly mobile joint (Sharmila devi Devaraj and Pradeep D, 2014).

The utmost important functions of the mandibular joint were mastication and speech and it was of great importance to dentists, orthodontists, and radiologists (X. Alomar *et al*., 2007).

The TMJ was a "ginglymoarthrodial joint" a term that derived from "ginglymus", meaning the hinge joint, allowing movement only backward and forward in a single plane, and arthrodial, meaning the joint of which permits the gliding movement of the surfaces. The left and right TMJ form a "bicondylar articulation" and ellipsoid variety of the synovial joints, similar to the knee joint articulation. Nevertheless, the features that differentiate and made this joint unique were its articular surface covered by fibrocartilage, as an alternative of hyaline cartilage. (Williams PL, 1999).

1.1 Embryology

Berkovitz BKB *et al*., 2002 stated that at approximately at (10 weeks) of intrauterine life, the components of the fetus' future joint became obvious. The "Temporal/glenoid blastema" ossifies and became the glenoid fossa, condylar blastema-becomes the condylar cartilage (Figure 1-1).

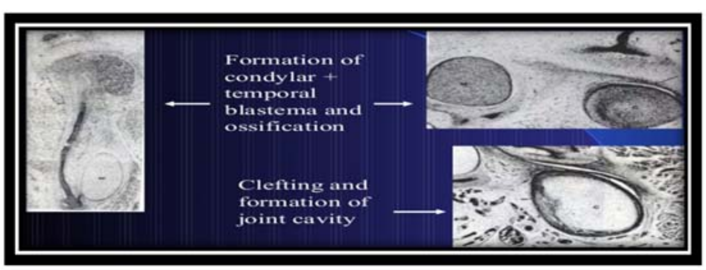


Figure (1-1) Temporal/glenoid blastema

By the (10th wk I.U.), ossification begins in the temporal blastema along with the resorption of the "Meckel's cartilage". Ossification followed in the (12th wk I.U.) by formation of a ventral and dorsal intra-cartilage cleft, which will later differentiate into the superior and inferior joint cavities. The "intervening cartilage" left between the emerging clefts results in the primitive articular disc shaped. Further mesenchymal condensation and organization, by the (20th wk I.U.) results in differentiation of the complex into the discrete components of joint (S.N. Bhaskar, 2011).

1.2 Anatomy of tempromandibular joint

1.2.1 Mandibular Component

This component comprises of an ovoid "condylar process" seated atop a thin mandibular neck. It was (15 to 20 mm) side to side and (8 to 10mm) from front to back. Thus, if the long axes of two condyles extended medially, they meet at the basion, on the anterior edge of the "foramen magnum". The lateral pole of the condyle was rough, bluntly pointed, and projects only moderately from the plane of ramus, while the medial pole, extends sharply inward from this plane. The articular surface lies on its anterosuperior aspect, thus, facing the posterior slope of the articular eminence, of the squamous temporal bone.

Yale SH: point out in 1969 that, the appearance of the mandibular condyle, varies significantly among different age groups and individuals. The Morphologic changes, might occur on the foundation of simple developmental inconsistency, as the condyle remodeling to accommodate developmental variations, malocclusion, trauma, and other developmental abnormalities.

1.2.2 Cranial Component

The articular surface of the temporal bone, located on the inferior aspect of temporal squama, anterior to the tympanic plate. Various anatomical terms, of the joint explained below.

(a) Articular eminence: This was the entire transverse bony bar, which involve the anterior root of zygoma. This articular surface, was severely traveled by the condyle and disk as they moved forward and backward in normal jaw function.

(b) Articular tubercle: This was a small, raised, rough, bony knob on the outer end of the "articular eminence". It projects, beneath the level of the articular surface and serves, to attach the lateral collateral ligament of the mandibular joint.

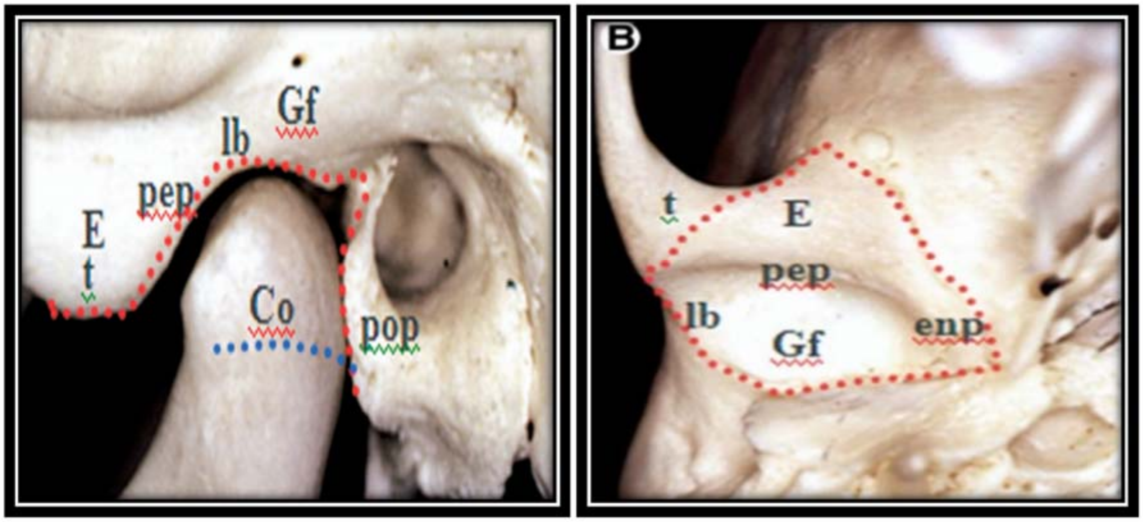


Figure (1-2) Cranial Component of tempromandibular joint E: Articular eminence; enp: entogolenoid process; t: articular tubercle; Co: condyle; pop: postglenoid process; lb: lateral border of the mandibular fossa; pep: preglenoid plane; Gf: glenoid fossa; Cp: condylar process.

(c) Preglenoid plane: This was the somewhat hollowed, nearly horizontal, articular surface continuing anteriorly from the height of the articular eminence.

(d) Posterior articular ridge and the postglenoid process: The posterior part of the "mandibular fossa" was the anterior margin of the "petrosquamous suture". Moreover, it elevated to form a ridge known as the "posterior articular ridge or lip". This ridge increases in height laterally, to form a thickened cone-shaped prominence called the "post glenoid process" immediately frontal to the external acoustic meatus.

(e) Lateral border of the mandibular fossa: This structure usually raised, to form a slight crest that linking the articular tubercle, in front, with the postglenoid process behind.

(f) Medially; the fossa narrows considerably, and bounded by a bony wall that is the "entoglenoid process", which passes slightly medially as the "medial glenoid plane".

The roof of the mandibular fossa, that separates it from the middle cranial fossa, was always translucent and thin, even in the heavy skull. This reveals that, although the articular fossa contains the disk and the condyle, it was not a functionally "a stress-bearing part", of the craniomandibular articulation (Patnaik VVG *et al*., 2000).

1.2.3Articular Disk

The "articular disk" was the most substantial anatomic structure of the TMJ. It was a "biconcave fibrocartilaginous structure" situated between the mandibular condyle and the temporal bone component of the joint. Its purposes, to accommodate a hinging movement in addition to the gliding movement between the temporal and mandibular bone. It was a roughly ovoid, firm, fibrous plate with its long axis traversely fixed, that divides the joint into a larger superior compartment, and a smaller inferior compartment. The Hinging movements, take place in the inferior compartment and the gliding movements, take place in the superior compartment (Rashmi GS Phulari, 2014).

The higher surface of the disk assumed "saddle-shaped" to fit into the cranial outline, while the lower surface was concave to fit the mandibular condyle. The disc was dense, oval shaped, divided into an "anterior band" about 2 mm in thickness, a "posterior band" of 3 mm thick, and thin in the center "intermediate band" of 1 mm thickness. More posteriorly, there was the bilaminar or retrodiskal area. The disc attached all about the joint capsule, except for the "tough straps" that fix the disc to the medial and lateral condylar poles, which ensure that the disk and condyle move together in the protraction and the retraction. The anterior extension of the disc, attached to a fibrous capsule superiorly and inferiorly. In between, it provides insertion to the lateral pterygoid muscle, where the fibrous capsule was lacking, and the "synovial membrane" supported by loose areolar tissue.

Harms SE and Wilk RM, mentioned in 1987 that the anterior and posterior bands, had primarily transversal running fibers, while the thin intermediate zone, had anteroposteriorly-oriented fibers.

Posteriorly, the "bilaminar region" includes two layers of fibers separated by a loose connective tissue. The superior layer or temporal lamina composed of elastin and attached to the "postglenoid process", a medially extended ridge, which was the exact posterior boundary of the joint. It prevents slipping of the disk during yawning. The inferior layer of the fibers or inferior lamina bend down behind the condyle to fuse with capsule, and back of the condylar neck at the deepest limit of the joint space. It inhibits extreme rotation of the disc over the condyle. In between the two layers, an expansible, soft pad of blood vessels and nerves were squeeze and wrapped in elastic fibers, that aid in contracting vessels and retracting disc in recoil of closing movements. When the mandible is in the closed mouth position, the thick posterior band lies directly above the condyle near the "12 o'clock position" (Rashmi GS Phulari, 2014).

The retrodiskal attachment tissues were the "intra-articular part" of the joint posterior to the condyle and the disc. Functionally, the condyle and the disk seated more anteriorly; being strictly clear when the condyle and the disk were in centric relation. The volume of retrodiskal tissue must increase instantaneously when the condyle translates anteriorly (Axel Bumann and Ulrich Lotzmann, 2002).

That tissue crumpled and compressed, in the joint space when the mouth in a closed position. The superior part of the retrodiskal attachment, had a prominent vascular shunt and this vascular network contained within loosely organized, collagen, elastin and fat and responsible for, retracting the articular disk during closure. Possibly because the disk tends to merely rotate against the condyle, the inferior lamina stretches out, and serves to stabilize the disc on the condyle and composed of comparatively inelastic and intensely packed collagen

Sagittal view MR imaging demonstrate that, the disc appears as a biconcave assembly with homogeneous low signal intensity that attached posteriorly to the bilaminar zone, which demonstrates, an intermediate signal intensity. The anterior band of disc lies directly anterior to the condyle, and the junction of the bilaminar zone and the disc lies at the superior part of the condyle (David C. Hatcher and Dania Tamimi, 2016).

The posterior band and the retrodiskal tissue, best represented in the open-mouth position. In the coronal plane the posterior band of the disc identified as low signal intensity tissue above the condyle, while in the axial plane, the anterior band demonstrated as low signal tissue in front of the condyle. The coronal and axial planes of MRI, ideal to demonstrate, the medial and lateral disc displacement (Helms CA *et al*., 1989).

1.2.4 Muscle of Mastication

Numerous muscles were responsible for mandibular movement, and the motion of the "mandibular muscles" were a well-coordinated complex event. These muscles can grouped into the "muscles of mastication" and the "suprahyoid muscles" (Rosentiel SF et al., 1995).

There were four sets of muscles of mastication; the temporalis, the masseter, the medial, and lateral pterygoids muscles. The bulk of "temporalis" originated from an area limited by the inferior temporal line above "infratemporal crest" and inserted, into the medial side of the anterior border of the ramus. The anterior fibers were most frequently tender as they were the main elevators of the jaw. Besides, the elevation of jaw, the posterior fibers retract the mandible and closed the mouth.

The "masseter" muscle originated from the anterior two-thirds, of the zygomatic arch and inserted, into the outer aspect of the angle of the mandible, it elevated the jaw.

The "lateral pterygoid muscle" originates from the lateral side of the lateral pterygoid plate and inserts into the anterior border of the condylar head and the intra-articular disc, through two independent heads. The superior and inferior heads, of the "lateral pterygoid muscle" both inserted into the pterygoid fovea area of the mandible with a part of the superior head inserted into the disc and the capsule. It was, consequently should be considered as two distinct muscles; the inferior belly (inferior lateral pterygoid) was active during protrusion, depression, and lateral movement, and the superior lateral pterygoid, active through closure (Johnson DR and Moore WJ. 1989).

The "Medial pterygoid muscle" originated from the area between the medial and lateral pterygoid plates and inserted into the medial side of the angle of the mandible. The Elevation of the mandible produced by the, temporalis, masseter and the medial pterygoid muscles of both sides together (Sumaia AbdElgadir, 2004).

The Depression produced by the digastric, the geniohyoid and the lateral pterygoid muscles of both sides acted together, and by the mylohyoid muscle. The Protrusion effected by the "medial and lateral pterygoid muscles" of both sides acting together, and the retraction by the posterior fibers of the two temporal muscles. The Lateral movement effected by the "medial pterygoid muscle" of one side acted in conjunction with the "lateral pterygoid muscle" of the opposite side. On the side to which the jaw moves, the condyle remains stationary; on the contrary side the condyle and disc moved downward and forward on the articular slope of the glenoid fossa as the protrusion. This arrangement assisted in maintaining the integrity of the "condyle - disk assembly" by pulling the condylar head firmly, against the disc (Michael FA and Headly EB 1984).

The muscles of the "suprahyoid group" had a dual function. They elevate the hyoid bone or depress the mandible; which movement arises, depends on the contraction of the other muscles, of the neck and jaw region (Rosentiel SF *et al*., 1995).

1.2.5 Fibrous Capsule

The fibrous capsule, was a thin sheath of tissue surrounding the joint. It extends from the boundary of the temporal articular surface to the neck of the mandible. The outline of the capsular attachment, on the cranial base can be followed "anterolaterally" to the articular tubercle, laterally to the lateral rim of the mandibular fossa, "posterolaterally" to the postglenoid process. "Posteriorly" to the posterior articular ridge, "medially" to the medial margin of the temporal bone, at its suture with the greater wing of the sphenoid, and finally, "anteriorly" it attached to the preglenoid plane (Patnaik VVG *et al*., 2000)

Anteriorly, the capsule had an orifice through which the lateral pterygoid tendon passes figure (1-3). This area of comparative weakness in the capsular lining became a cause of probable "herniation of intra-articular tissues" and this, may allow the forward displacement of the disc (Kreutziger KL *et al*, 1975).

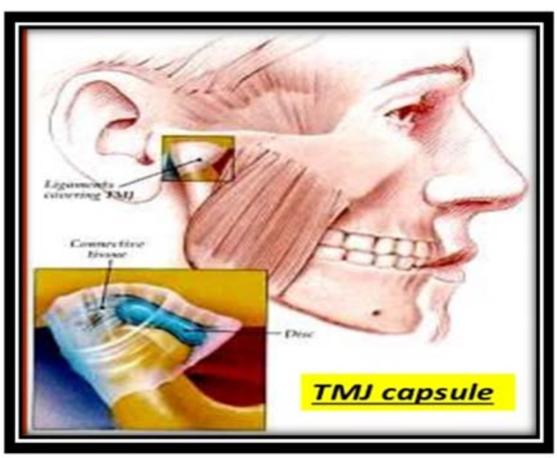


Figure (1-3) tempromandibular joint capsule

Since, the articular disc attached to the internal surface of the capsule, separating the joint cavity into two compartments, the fibers extend from the condyle to the disk and from the disk to the temporal bone to form two joint capsules.

The synovial membrane lining the capsule covers all the" intra-articular surfaces" excepting the pressure-bearing fibrocartilage. The lower and upper compartments form fluid-filled folds (sulci) in the joint cavity. Thus, there were four capsular or synovial sulci situated at the posterior and anterior ends of the upper and lower compartments. These sulci altered their form during translatory movements, which necessitates the "synovial membrane" to be flexible (Toller PA, 1974).

1.2.6 Tempromandibular joint ligament

The ligaments of the mastication system, as in all other movable joints, had three central functions: guidance of movement, limitation of movement and stabilization (Mankin and Radin 1979, Osborn 1995).

Five ligaments have described; the lateral ligament, the stylomandibular ligament, the sphenomandibular ligament, the discomalleolar (Pinto's) ligament and the Tanaka's ligament. Occasionally the collateral attachment fibers between disc and condyle might include in the list as the "lateral and medial collateral ligaments" of the disc (Yung *et al*., 1990, Kaplan and Assael, 1991, Okeson, 1998).

The "lateral ligament or TMJ ligament" made up of two portions: a deep, more horizontal part and a superficial, more vertically oriented portion (Kurokawa 1986) (Fig. 1- 4). The horizontal portion limits the retrusion (Hylander 1992) as well as the Laterotrusion (DuBrul 1980) and thereby guards the sensitive "bilaminar zone" from damage. The vertical part, of the lateral ligament, on the other hand, limits the jaw opening (Osborn 1989, Hesse and Hansson 1988).

The superficial portions of the lateral ligament (vertical part) contain Golgi tendon organs (Thilander 1961). These nerve endings very vital for the neuromuscular checking of mandibular movements (Hannam and Sessle 1994, Sato et al. 1995). For this cause, anesthetizing the lateral part of the joint permits a (10-15%) increase in mouth opening (Posselt and Thilander 1961).

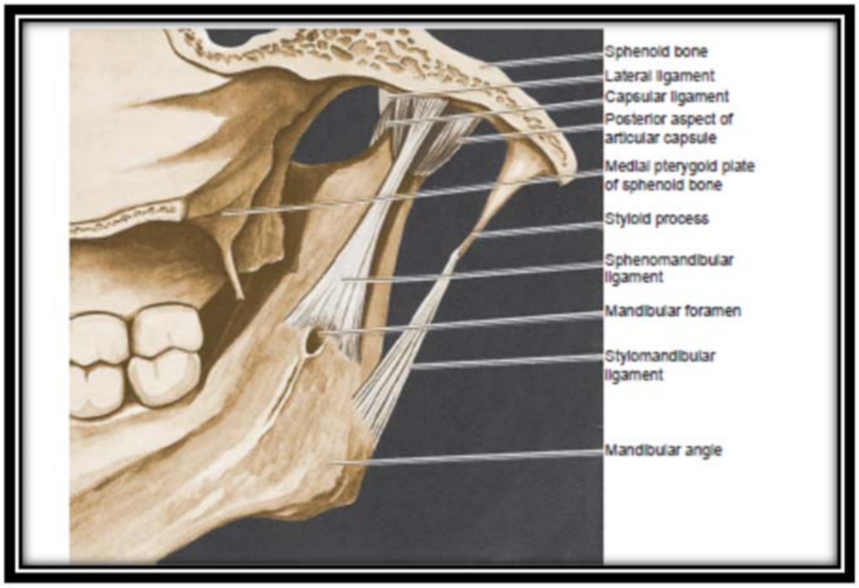


Figure (1-4) Accessory ligaments of the temporomandibular joint drawn from a medial view.

The "sphenomandibular ligament", a remnant of the Meckel cartilage, was a smooth band that spans the space between the (spine of the sphenoid bone and the lingula at the mandibular foramen). The sphenomandibular ligament restricts the protrusive and mediotrusive movement (Langton and Eggleton 1992) in addition to the passive jaw opening (Hesse and Hansson 1988, Osborn 1989).

The "stylomandibular ligament", the additional accessory ligament, was a specialization of the deep cervical fascia (Toller PA:, 1974). This ligament extends as a thin band from the (top of the styloid process of the temporal bone to the posterior border of the angle and ramus of the mandible). It had suggested that the "stylomandibular ligament" apparently contributes in limiting the anterior magnitude of protrusion of the mandible, it also restricts protrusive and mediotrusive movements (Burch 1970, Hesse and Hansson 1988).

The "discomalleolar ligament" (Pinto's ligament) was described by Pinto (1962) as a connection, between the malleus and the medial wall of the joint capsule. Nevertheless, a separate ligament could confirmed, here in only 29% of temporomandibular joints (Loughner *et al.*, 1989).

"Tanaka's ligament" represent (cord-like reinforcement) of the medial capsule wall, comparable to the lateral ligament (Tanaka,1988).

1.2.7 Innervation and Vascularization

The joint capsule richly supplied with sensory endings from the mandibular division of the "trigeminal nerve", most of which supplied from articular branches of the "auriculotemporal nerve" (see Fig. 1-5). Supplementary articular branches al so supplying the joint, derived from the masseteric branch of the mandibular division of the "trigeminal nerve" (James L. Hiatt and Leslie P. Gartner 2010).

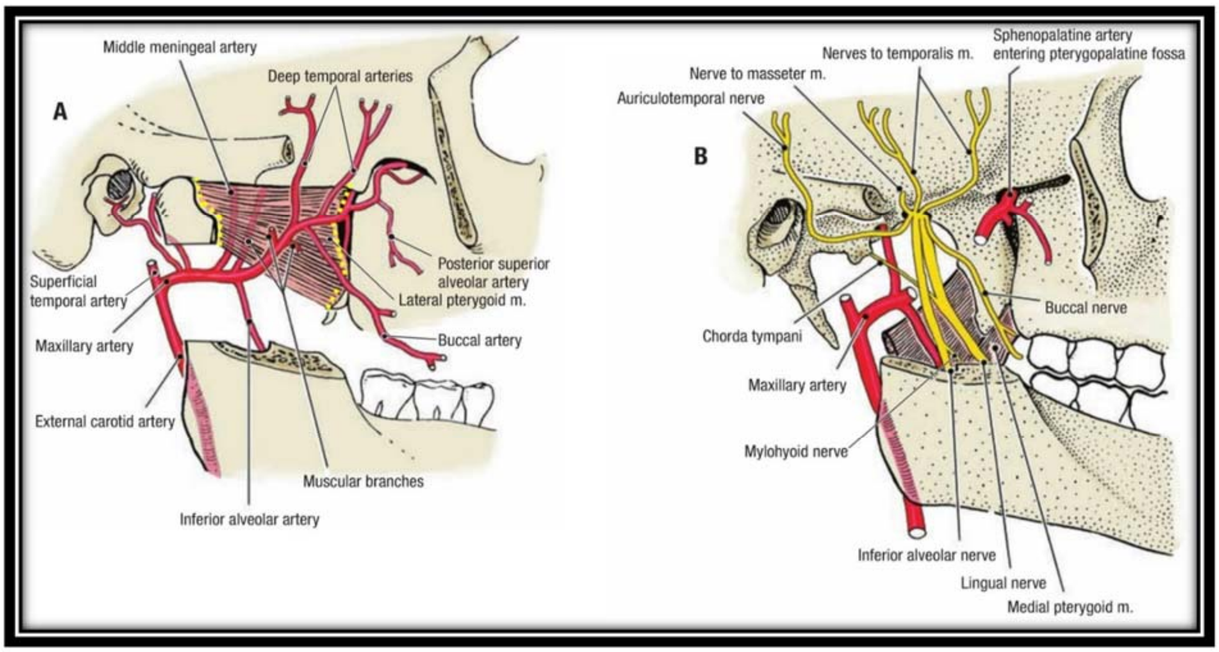


Figure (1-5): Tempromandibular joint innervation and blood supply

The arterial blood supply of the "temporomandibular joint" provided principally by the superficial temporal artery and the maxillary artery. The venous pattern more diffuse, creating a plentiful plexus around the capsule. Posteriorly, the retrodiscal pad copiously pierced with extensive venous channels. These "cavernous spaces" filled and empty as the condyle rocks forward, and backward, providing for Unhalted, smooth movement in normal joint action. A similar venous feature, seen anteriorly but to a lesser extent (X. Alomar *et al.*, 2007).

1.3 The Movement of the Mandible

The Mandibular movement, occurs as a complex series of organized three-dimensional rotational and translational actions. It determined by the combined and simultaneous actions of both temporomandibular joints (TMJs). Although the mandibular joint, cannot function totally independently of each other, they also infrequently function. It was beneficial first to separate the movements that occur within a solitary TMJ (Jeffrey P. Okeson, 2013).

Ash CM. and Pinto OF. in 1991 stated, that Movement was not only guided by the shape of the bones, muscles, and ligaments but also by the "occlusion of the teeth", since both joints were joined by a single mandible bone and cannot move independently of each other.

Types of Movements

Two types of movements occur in the mandibular joint: the rotational and translational.

1.3.1. Rotational Movement

The "Dorland's Medical Dictionary", in 2012 defines rotation as “the process of turning around an axis: movement of a body, about its axis.” In the masticatory system, rotation occurred when the jaw opens and closes around a static point or axis within the condyles. In other words, the teeth can be separated and then occluded with "no condylar positional change".

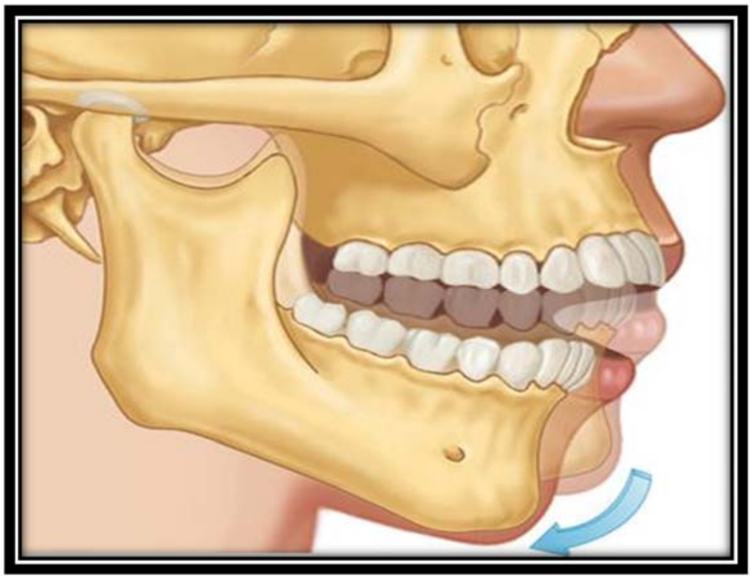


Figure (1-6) Rotational movement about a fixed point in the condyle.

Sridhar Premkumar in 2015 stated that rotation occured as movement within the inferior cavity of the joint. It is thus, movement between the superior surface of the condyle and the inferior surface of the articular disk. Rotational movement of the mandible, could occur in all three reference planes: horizontal, frontal (vertical), and sagittal. In each plane, it arises around a point called the axis figure (1-6).

1.3.1.1 Horizontal axis of rotation

The Mandibular movement, around the horizontal axis was an opening and closing movement. It referred to as "a hinge movement", and the horizontal axis around which it occurs therefore referred to as the "hinge axis" (Figure 1-7). The hinge movement was probably the only mandibular activity in which a “pure” rotational movement occurs. In all other movements’ rotation around the axis, supplemented by translation of the axis (Sharma, Ashu *et al*., 2012).

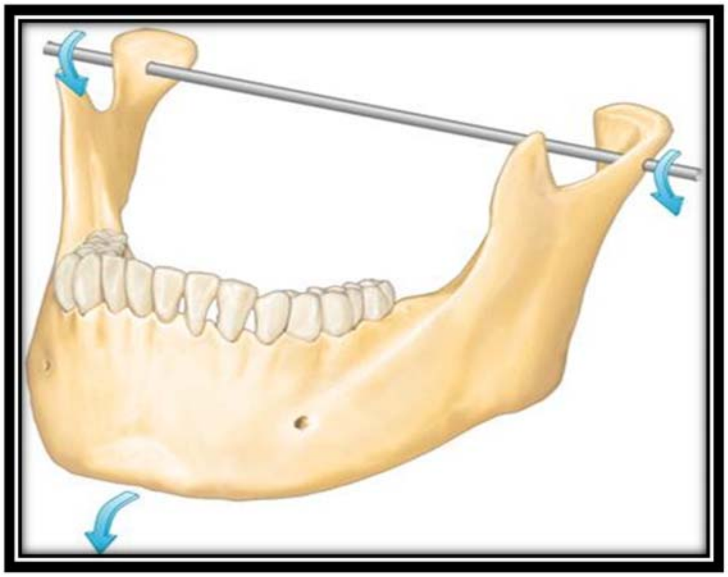


Figure (1-7) Rotational movement around the horizontal axis.

When the condyles were in their utmost superior position in the articular fossae, and the mouth was purely rotated open, the axis around which movement occurs called the "terminal hinge axis". The Rotational movement around the terminal hinge could readily demonstratedو but rarely occurs during normal function (Manu Rathee *et al*., 2014).

1.3.1.2. Frontal (vertical) axis of rotation

The Mandibular movement around the frontal axis, occurred while one condyle moved anteriorly out of the "terminal hinge position" with the vertical axis of the opposite condyle remaining in the "terminal hinge position" figure (1-8). Because of the inclination of the articular eminence, which prompts the frontal axis, to tilt as the moving or orbiting condyle travels anteriorly, this type of movement did not occur naturally (Jeffrey P., Okeson, 2013).

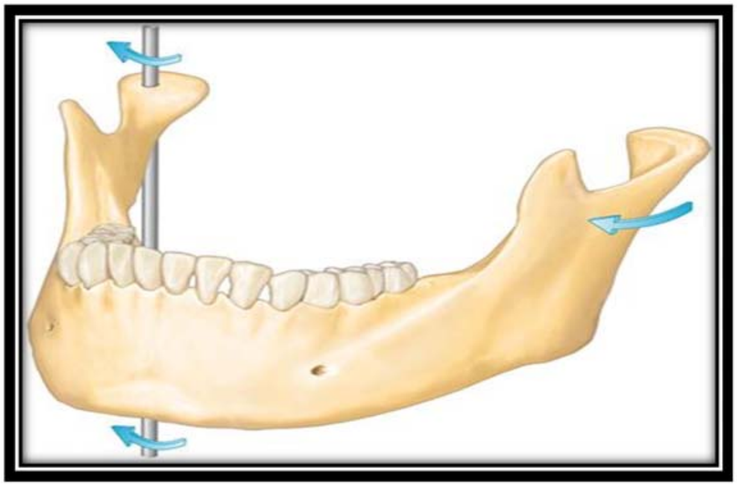


Figure (1-8) Rotational movement around the frontal (vertical) axis.

1.3.1.3 Sagittal axis of rotation

The Mandibular movement around the "sagittal axis" occured when one condyle moves inferiorly while the other remains, in the "terminal hinge position" Figure (1-9). Because of the ligaments and musculature of the mandibular joint prevent an inferior movement of the condyle; this type of isolated movement didn't occur naturally. It does occurred in combination with other movements, nevertheless, when the "orbiting condyle" moves downward and forward across the eminence (peter E. Dawson., 2007).

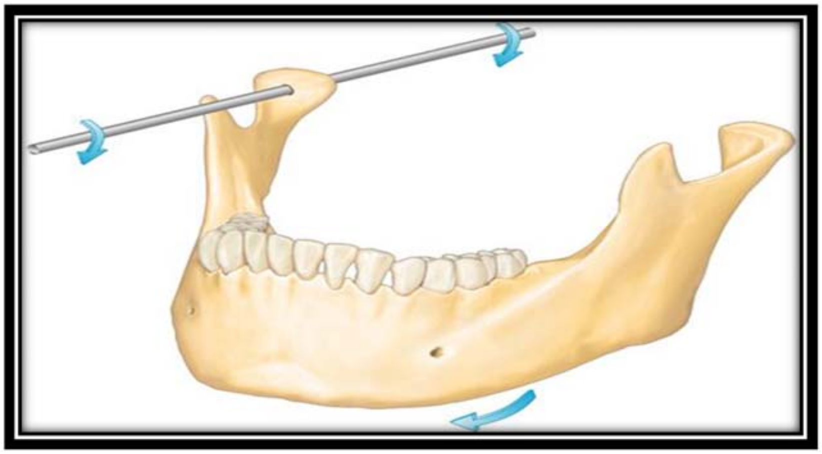


Figure (1-9) Rotational movement around the sagittal axis

1.3.2 Translational Movement

The Translation could defined as a movement, in which every point of the moving object concurrently had the same direction and velocity. In the masticatory system, it occurred, when the mandible moved forward, as in protrusion. The teeth, condyles, and ramus all move in the identical direction to the similar degree (figure1-10).

Translation usually occurred within the superior section of the joint between the superior surface of the articular disk and the inferior surface of the mandibular articular fossa (Ola Grimsby and Jim Rivard, 2009).

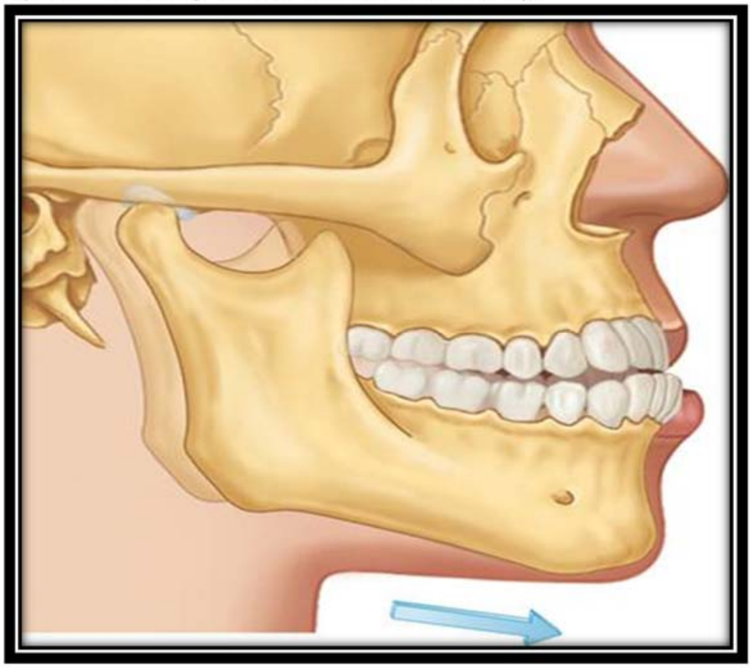


Figure (1-10)

Translational movement of the mandible.

During normal movements of the jaw, both rotation and translation occur simultaneously. Whereas the mandible was rotating around one or more of the axes, each of the axes, was translating (changing its orientation in space). These results in compound movements, that were extremely difficult to visualize (S.J. Lindauer *et al*., 1995).

1.3.3 Bennett movement

The "Bennett movement" was"a complex lateral movement, or lateral shift of the mandible, resulting from the movements of the condyles along the lateral slopes of the mandibular fossae during the lateral jaw movement (Stiesch-Scholz M *et al*., 2006).

Okenson, in 2013 stressed that During a lateral excursion, the "orbiting condyle" moves downward, forward, and inward in the mandibular fossa around axes located in the opposite the rotating condyle. The degree of interior movement of the "orbiting condyle" determined by two factors: the morphology of the medial wall of the mandibular fossa, and the inner horizontal portion of the "temporomandibular ligament". The lateral translation movement has three features: the amount, timing, and the direction. The amount and timing, of lateral movement determined partially, by tempromandibular ligament and medial wall of mandibular fossa. The more, medial the wall from the medial pole of the "orbiting condyle", the larger the amount of lateral translation movement; the more loosely the TML joined to the rotating condyle, the greater the lateral translation movement.

The amount of "lateral translation movement" determined by how firmly the inner horizontal portion of the TML bonded to the "rotating condyle" as well as the extent to which the medial wall of the mandibular fossa departs from the medial pole of the "orbiting condyle". As the lateral translation movement increases, the bodily shift of the mandible dictates that the posterior cusps, must be shorter to permit the lateral translation, without creating contact between the mandibular and maxillary posterior teeth.

The direction of shift of the "rotating condyle" during a lateral translation movement, determined by the osseous morphology and ligamentous attachments of the TMJ undergoing rotation. In addition to lateral movement, the "rotating condyle" may also move in a superior, inferior, anterior, or posterior direction. Moreover, a combination of these can occur. In other words, shifts might be laterosuperoanterior, lateroinferoposterior, etc.

Of significance as an element of cusp height and fossa depth was the vertical movement of the "rotating condyle" during a lateral translation movement (the superior and inferior movements). Thus, a laterosuperior movement of the rotating condyle will require shorter posterior cusps, than will a straight lateral movement; similarly, a lateroinferior movement will permit longer posterior cusps, than will the straight lateral movement. Hence, there was a close relationship between the design of Bennett's movement and the structure of the teeth since, during the movement, the cusps must not interfere with the opponent ones but must move through well-identified ways of escape, which were actually sulcus and cusps.

Timing of the lateral translation movement was a function of the medial wall nearby to the "orbiting condyle" and the attachment of the TML to the "rotating condyle". These two settings determine when this movement occurs, during a lateral excursion. Of the three characteristics of the lateral translation movement (amount, direction, and timing), the last had the highest influence, on the occlusal morphology of the posterior teeth. If the "timing" occurred late, and the maxillary and mandibular cusps were beyond functional range, the amount and direction of the "lateral translation movement" will have slight, if any influence on occlusal morphology. However, if the "timing" of this movement occurs early, in the laterotrusive movement, the amount and direction of the lateral translation movement, will influence occlusal morphology (FAWAZ ALQAHTANI, 2015).

The Bennett movement involves of two movements: the "immediate Bennett side-shift" which occurs at the beginning of the translation, and the "progressive Bennett side shift". In the "immediate Bennett side shift", the "orbiting condyle" moved fundamentally straight medially as it leaves centric relation at the start of the lateral jaw movement. While the "progressive Bennett side shift" creates an angle (the Bennett angle) formed, by the sagittal plane and the pathway of the advancing condyle during lateral mandibular movement as it viewed in the horizontal plane (E. FANUCCI, E. SPERA *et al.*, 2008).

1.4 Horizontal and transverse condylar inclination

The angle that formed by the inclination of "a condylar guide control surface" of an articulator and the specified reference plane was the condylar guide inclination (The Glossary of Prosthodontic, 2005).

Figure (1-11) Semi adjustable articulator with condylar member

A Sowjanya Godavarthi, *et al*., 2015 point out that condylar inclination was described as the mandibular guidance, produced by the condyle and articular disc, traversing the outline of anterior slope of the glenoid fossae. Radiographically, the angle made in the horizontal plane between the horizontal Frankfurt plane and a line connecting a point on the head of the condyle, in the centric and protrusive position was referred to as the horizontal condylar angle figure (1-16).

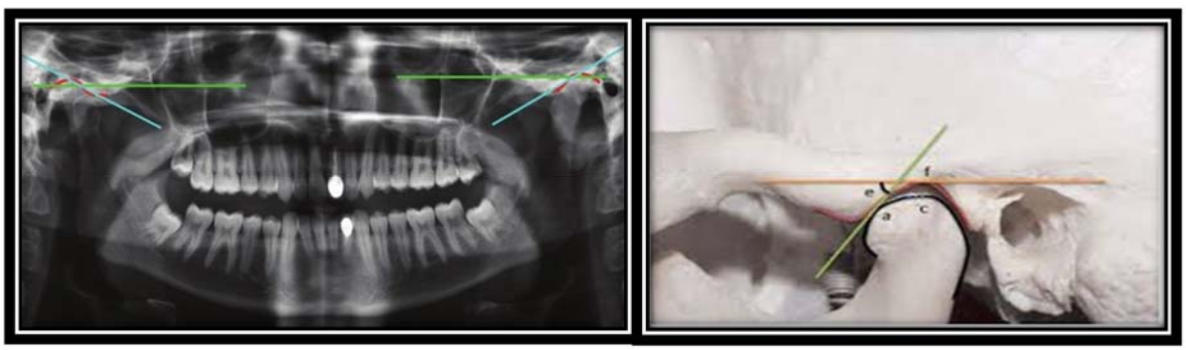


Figure (1-12) Horizontal condylar angle

The goal of a "prosthodontic rehabilitation", was to construct a prosthesis, which in harmony with the stomatognathic system. The essential consideration, in the oral rehabilitation of any patient was the inclination of the condylar path. The determination of this "condylar angle" was important when planning a restoration, which modifies the occlusal morphology of the teeth. The Steepness of this angle, determines the lingual inclines of the anterior teeth as well as the steepness of the cusps, of the posterior teeth (Jose dos Santos Jr, 1999).

T. Sreelal, *et al*. 2013 stated that the Age related changes in the glenoid fossa and condyle could affect the steepness of this angle which if not measured may result in unfavorable "premature contacts" during the centric and eccentric jaw movements.

The Horizontal condylar angle could be determined, by various methods including the interocclusal records (Ratzmann A *et al*., 2007), the pantographic tracings (Curtis DA, 1989), the electronic jaw tracking devices (Hernandez AI et al, 2010), and radiographic methods (Tannamala PK *et al*., 2012). The protrusive interocclusal records used on the "semiadjustable articulator" for setting horizontal condylar inclination after mounting the upper and lower stone casts with the centric interocclusal record.

The purpose of the protrusive jaw relation that determine the "condylar angle" was to set the condylar elements of the articulator, so that they will reproduce inclinations, which were similar or equivalent to that of the patient's temporomandibular articulation (Aull AE., 1965).

Smita A khalikar *et al*., 2017 claimed that protrusive records and OPG might used as a reliable guide for assessing condylar guidance angulation.

However, many practitioners depend on the average values of the condylar guidance, which range from 22° to 65° (Payne JA, 1997). If the individual inclination, of the articular eminence was very steep or flat, the guidance derived from the mean value settings might lead to incorporation of imprecisions. While achieving particular clinical objectives such as balanced occlusion (Gilboa I, 2008).

Deepak Nallaswamy in 2007 stated that transverse condylar angle (Bennett angle) was the angle formed between the "sagittal plane" and the average path of the advancing condyle, as viewed in the horizontal plane, during the lateral mandibular movement.

In an occlusal rehabilitation, the "Bennett angle" had a very high gnathological significance since, its presence and size affect the occlusal relationships of denture construction, Miscalculations in evaluating the "Bennett angle" will affect the (ridges and groove positions) in the working and nonworking sides and, to a slighter extent, the height of cusp (Koolstra JH, 2002).

Most semiadjustable articulators allow for a "Bennett movement" of the orbiting condyle, to be only a straight line from the centric relation in which the casts mounted to the extreme laterotrusive position. A few also provide adjustment for (immediate and progressive Bennett shift movements). When a significant immediate lateral translation movement was present, these articulators; provide a more accurate duplication of condylar movement (Jeffrey P.Okenson, 2013).

Samir Cimi *et al*., 2016 stated that the average value of transverse condylar inclination for subject without sign and symptoms of mandibular joint dysfunction was roughly around 8□.

1.5. Tempromandibular joint imaging

Evaluation of mandibular joint started, with a detailed patient history and clinical examination. However, other patients will require "diagnostic imaging" of the TMJs in order to provide information, which was not available from the clinical examination (Rugh, JD and Solberg WK 1985).

TMJ imaging, indicated in the following: conservative treatment; that has unsuccessful or symptoms are worsening, the patients with a trauma history, substantial dysfunction, major changes in occlusion. If an osseous anomaly suspected, or history of TMD and the treatment plan, includes broad reconstructive work or orthodontia, since these kinds of treatment can alter the occlusion and influence the patient to a repetition of their TMD symptoms (Petrikowski CG., 2004).

The major purpose of TMJ imaging, to contribute in building the diagnosis of mandibular joint disorder (Brooks SL et al, 1997).

C. Grace Petrikowski in 2005 stressed that the choice of imaging technique, will depend on the "precise clinical problem", whether hard or soft tissues imaged, the radiation dose, cost, availability of the imaging procedure. Frequently the "hard tissues" imaged first to evaluate osseous border, the positional relationship of the condyle and glenoid fossa, and the range of movement. "Soft tissue" imaging indicated, when information about disc position or morphology requested or to image abnormalities in the nearby soft tissues. Images presented in a minimum of two planes perpendicular to each other, such as the frontal and lateral planes. Views at further orientations, allowing three-dimensional assessment of the TMJ.

1.5.1 Hard Tissue Imaging

1.5.1.1. Panoramic radiography

A panoramic radiograph considered a "screening projection" and often-used in combination with other hard tissue imaging procedures to image the TMJs (Fig 1-13). It gave an overview of the jaws and teeth, permitting evaluation of mandibular symmetry, maxillary sinuses and dentition. Mandibular asymmetries may not be clinically evident, and a discrepancy in size of one condyle may be a contributing factor, in the progress of TMD (Yamada K, *et al.*, 2000).

Condylar site, cannot evaluated, because the patient placed in a protrusive and somewhat open position. Moreover, the glenoid fossa, did not image clearly and the articulating surfaces of the condyles, distorted due to the angle of the projection, so osseous components of the joints cannot accurately evaluated.

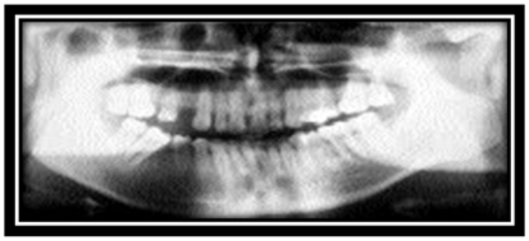


Figure (1-13) Panoramic view illustrating hyperplasia of the right Mandible and TMJ, resulting in a mandibular asymmetry.

1.5.1.2. Cephalometric radiography

The "Cephalometric plain radiographs film", were frequently indicated as an adjunct to the TMJ imaging study, mainly in patients with developmental anomalies, neoplasms, fractures of the jaw or condylar necks, or the facial asymmetries (Petrikowski CG., 2004). (Fig 1-14).

Figure (1-14) Lateral cephalometric view

1.5.1.3 Tomography

The Imaging of the TMJ best accomplished by the use of tomography, which has the advantage of representing the TMJs in thin layers or slice increments. The joints can imaged in different directions, attaining the aim, of producing views perpendicular to each other. "Tomography" may carried out using the conventional tomography or computed tomography.

A-Conventional tomography

By the "conventional tomography", several exposures made with the area of notice moving through the plane of focus. This produces an undistorted vision of joint morphology and allows accurate evaluation of condylar position.

Normally, several image slices in the sagittal (lateral) and coronal (frontal) plane made (Mintzer RA et al.,1979). Most commonly, the sagittal views exposed with the teeth in the closed (maximum intercuspation) and the (maximum open positions) but further views, with a splint or bite registration in place might taken (Fig. 1-15).

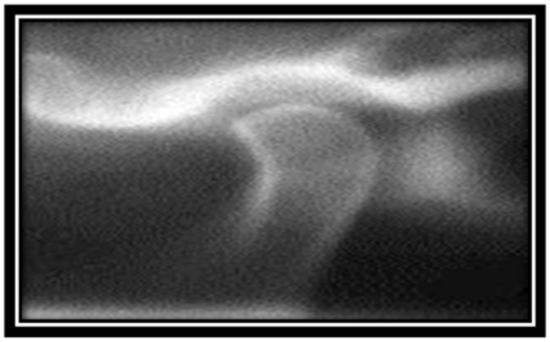


Figure (1-15) Conventional tomographs of the left TMJ. Closed position.

B- Computed Tomography

The Computed tomography (CT) was a more sophisticated digital tomographic technique, where the patient exposed to a "fan-shaped x-ray beam" focused to a series of detectors. The detectors and the x-ray beam travel around the patient, to obtain numerous projections at several angles. The data from these projections used to recreate the image, which observed on a computer monitor. CT has several advantages: there was no superimposition of structures outside the area of interest, contrast resolution improved, so that tissues with small differences in density can distinguished, data from one imaging study can observed in various planes and three-dimensional images can constructed. If the scan contains the rest of the skull, the necessity for "cephalometric plain film" views eradicated (C. Grace Petrikowski, 2005).

Advantages of CT

The "Structural relationships" of hard and soft tissues can observed directly; the Differences between tissues that differ in physical density by less than 1 percent noted. The ability to rotate images, and to add or take away structural components, permits the relationships to be studied. Linear and volumetric measurements can made. The Elimination of superimposition of images of structures, external to the area of interest. (Barton F Bransetter and Jane L Weissman, 2000).

Limitations of CT

The consequence of blurring was much more than in conventional radiograph systems. The detail of a computed tomographic image was not as well as that available on other radiographs. Metallic objects such as fillings produce "marked streak artifacts" across the CT image. The equipment is very expensive (Freny R Karjodkar, 2008).

1.5.2. Soft Tissue Imaging

The "Conventional radiographic techniques", do not reveal the disk, so the disc position, function and integrity cannot assessed. Normally the hard tissues evaluated primarily; the soft tissue imaging, indicated when the symptoms unresponsive to conservative management, or when the clinical outcomes suggest a disc displacement. The Soft tissue imaging techniques include; arthrography and magnetic resonance imaging (Petrikowski CG.,2004).

1.5.2.1 Arthrography

The "Arthrography" was an invasive imaging technique to assess the TMJ. This imaging modality, requires injection of "radiopaque contrast" into the TMJ. Once the contrast injected, the joint can evaluated for adhesions, disk dysfunction, as well as disk perforation. This modality infrequently used today, because MRI can used to evaluate the TMJ without being invasive, possibility of infection, a possibility of allergic reaction from the contrast, or using radiation (Asim K Bag *et al*., 2014).

1.5.2.2 Magnetic Resonance Imaging (MRI)

It based that, the radiant energy was in the form of radiofrequency waves, rather than X-rays. This technique depend on the phenomenon of nuclear magnetic resonance, to produce a signal that can used, to create an image. It uses the "nonionizing radiation" from the radiofrequency band of the electromagnetic spectrum. Because of its exceptional soft tissue contrast resolution, MRI has proved useful in a variety of situations; diagnosing of internal derangement of the TM joint and assessing the treatment of the derangement after surgery, localization of orofacial soft tissue lesions and producing images of the salivary gland parenchyma.

Asim K Bag, *et al*., in 2014 stated that Magnetic resonance imaging (MRI) was the most broadly used and was diagnostic technique of choice and the primary modality for the evaluation of the temporomandibular joint (TMJ).

The Magnetic resonance imaging had replaced computed tomography as the primary modality in the assessment of the temporomandibular joint. Direct visualization of the disc afforded by MRI was a distinct benefit over "arthrography" (Rao VM *et al*., 1990). In spite of the supreme resolution of computed tomography and inadequate visualization of cortical bone by "Magnetic resonance imaging", most osseous pathology accurately represented (Laskin DM, 1993). The Intra-articular irregularities were readily observable on MRI images, providing additional information, not offered with other imaging modalities (Berquist T., 2000).

The typical protocol for MRI diagnosis of anterior disc displacement, usages the utmost superior surface (the 12 o'clock position) of the condyle as a reference point, for the posterior band of the disk. The posterior band of the disc positioned anterior to the (12 o'clock position) correlated to anterior disk displacement (M. Ahmad *et al*., 2009). The anterior superior part of the mandibular condyle and posterior slope of the articular eminence acknowledged as the functional regions on the articular surfaces of the TMJ (J. Okeson, 1996).

In MRI image, the normal disc has the lowermost signal intensity (i.e., darkest).The Thickening of the posterior diskal attachment could arises in some patients with ADD., appears as (a band-like structure) of low signal intensity substituting the normally bright signal from the posterior disc attachment (the pseudo disc sign) [Figure 1-16].

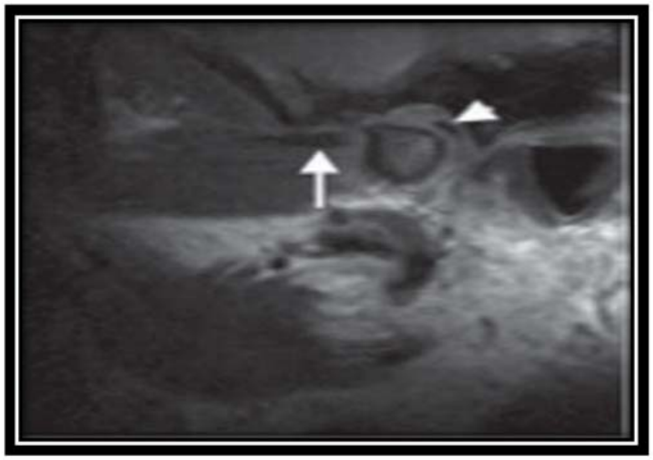


Figure (1- 16): Sagittal magnetic resonance image in closed-mouth position shows anteriorly displaced articular disc (arrow) and a hypointense band in the retrodiscal region (arrowhead) indicating thickening of posterior discal attachment “pseudo disc sign”

However the "powerful magnetic fields" generated by the MRI scanner will attract metal objects. For this reason, patient instructed to remove all the metallic belongings, such as watches and jewelry. Al so MRI scans can cause (heart pacemakers, defibrillation devices and cochlear implants) to malfunction (Freny R Karjodkar, 2009).

1.6 Tempromandibular joint disorder

The "Temporomandibular joint disorder "denoted to a cluster of conditions characterized by pain in the TMJ or its surrounding tissues, functional restrictions of the mandibular movement, or clicking in the TMJ during movement. TMJ disorders were common and often self-limited in the adult population. In epidemiologic studies, up to 75% of adults showed at least one sign of joint dysfunction on examination and as much as one third have at least one symptom (Rutkiewicz T *et al*., 2006). However, only five percent, of adults with "tempromandibular symptoms" require treatment and even scarcer developed chronic or debilitating symptoms (Hentschel K *et al*., 2005).

1.6.1 Aetiology

The TMJ was a synovial joint, which embraces an articular disk, that allows for hinge and sliding movements. That complex mixture of movements, allows for painless and efficient chewing, swallowing, and speaking. The articulating surfaces of the TMJ roofed by a fibrous connective tissue; this avascular and non-innervated structure, had a greater capacity to resist degenerative osseous change and regenerate itself than the "hyaline cartilage" of other synovial joints. The "synovial joint capsule and surrounding musculature" innervated, and thought to be the principal source of pain in TMJ disorders (Pertes RA, 1995).

The etiology of "mandibular joint disorder" was multifactorial and includes environmental, biologic, social, emotional, and cognitive triggers (ROBERT L. GAUER, and MICHAEL J. SEMIDEY, 2015).

JENNIFER J. BUESCHER in 2007 stated that the etiology of TMJ disorders remains uncertain, but it was likely to be "multifactorial". Capsule inflammation or damage and muscle pain or spasm may be caused by atypical occlusion, parafunctional habits (e.g., bruxism, teeth clenching, lip biting), stress, anxiety, or abnormalities of the intra-articular disc.

The "Abnormal dental occlusion" appears to be common in persons with and without TMJ symptoms, and occlusal correction did not reliably improve the symptoms or signs of Joint disorders (McNamara JA Jr *et al*., 1995).

Parafunctional habits thought to cause TMJ micro-trauma or masticatory muscle hyperactivity; nevertheless, these habits were also present in asymptomatic patients. Though parafunctional habits, might play a role in beginning or perpetuating symptoms in some patients, the "cause-and-effect" relationship remains undefined (Al-Ani MZ, *et al*., 2004).

According to Okeson JP in 1996, there was substantial evidence to suggest that anxiety, stress, and other emotional turbulences may exacerbate TMJ disorders, particularly in patients, who experience chronic pain. As many as 75 % of patients with TMJ disorders have a significant "psychological problem". Acknowledgement and treatment of concomitant mental illness was important in the overall approach to controlling chronic pain, including pain caused by "TMJ disorders".

1.6.2 Tempromandibular joint classification

Similar to many aspect of medicine, TMD overwhelmed, by inconsistent diagnostic categories and criteria. In an attempt to develop the TMD diagnostic terminology, a validation study followed by several sponsored international consensus workshops provided the worldwide-accepted validated diagnostic criteria (Schiffman EL, *et al*., 2013).

These diagnostic categories and criteria are part of the "American Academy of Orofacial Pain" (AAOP) guidelines. It was expected that these diagnostic terminology, to become universally accepted and used internationally, in all future communications (American Academy of Orofacial Pain. Diagnosis and management of TMDs, 2013).

The diagnostic categories principally separated into TMJ disorders and masticatory muscle disorders, but they also have two minor categories for "headache disorders" and "associated structures" (Figure 1-18). The recommended diagnostic criteria provide clinical diagnosis, based on information that could obtained from a patient’s history and clinical examination (Edward F. Wright, 2014).

They were not intended to be firm criteria, but only provide guidance, and clinical judgment should be count on for the final decision.

TMJ Disorders

I. Joint pain
  A. Arthralgia
  B. Arthritis
II. Joint disorders
  A. Disc-condyle complex disorders
    1. Disc displacement with reduction
    2. Disc displacement with reduction with intermittent locking
    3. Disc displacement without reduction with limited opening
    4. Disc displacement without reduction without limited opening
  B. Other hypomobility disorders
    1. Adhesions/adherence
    2. Ankylosis
      a. Fibrous ankylosis
      b. Osseous ankylosis
  C. Hypermobility disorders
    1. Subluxation
    2. Luxation
III. Joint diseases
  A. Degenerative joint disease
    1. Osteoarthrosis
    2. Osteoarthritis
  B. Condylysis
  C. Osteochondritis dissecans
  D. Osteonecrosis
  E. Systemic arthritides (e.g., rheumatoid arthritis)
  F. Neoplasm
  G. Synovial chondromatosis
IV. Fractures
V. Congenital/developmental disorders
  A. Aplasia
  B. Hypoplasia
  C. Hyperplasia

Masticatory muscle disorders

I. Muscle pain limited to the orofacial region
  A. Myalgia
    1. Local myalgia
    2. Myofascial pain with spreading
    3. Myofascial pain with referral
  B. Tendonitis
  C. Myositis
  D. Spasm
II. Contracture
III. Hypertrophy
IV. Neoplasm
V. Movement disorders
  A. Orofacial dyskinesia
  B. Oromandibular dystonia
VI. Masticatory muscle pain attributed to systemic/central disorders
  A. Fibromyalgia
  B. Centrally mediated myalgia

Headache disorders

I. Headache attributed to TMD

Associated structures

I. Coronoid hyperplasia

Figure (1-18) TMD Diagnostic Categories

The "Muscle and TMJ disorders" make up together group of conditions known as temporomandibular disorders (TMDs).

A- Muscles Disorders

Like any disorder, there are two main symptoms that could be detected: pain and dysfunction.

Certainly, the major complaint of patients with "masticatory muscle disorders," was muscle pain, which may range from minor tenderness. to extensive discomfort. Pain sensed in muscle tissue called myalgia, which can arise from increased intensities of muscular use. The symptoms related with a feeling of muscle tightness and fatigue. Although, the exact origin of this type of muscle pain unclear, some suggest, “it was associated to vasoconstriction of the relevant nutrient arteries and the accumulation of metabolic waste products in the tissues of muscle”. Within the ischemic area, of the muscle certain algogenic substances (e.g., bradykinins, prostaglandins) were released, causing the muscle pain(D.G. Simons, 2008).

The Muscle pain, nevertheless, was far more complex than simple fatigue and overuse. In fact, the "muscle pain" related with most TMDs does not seem to toughly correlated with increased activity such as spasm. It appreciated that muscle pain can be significantly influenced, by central mechanisms (S. Mense, 2009).

The severity of "muscle pain" straightly related to the functional activity, of the muscle involved. Therefore, patients often stated that the pain, influence their "functional activity". When the patient reports pain during chewing or speaking, these functional activities, were not the cause of this disorder. Instead, they intensify the patient's awareness of it. Thus, treatment directed toward the functional activity will not be appropriate or successful; rather, treatment must directed towards diminishing the muscle hyperactivity (Marcela Romero, *et al*., 2014).

The myogenous pain, could produce "central excitatory effects", these effects might present as sensory effects (i.e., referred pain or secondary hyperalgesia). In particular, muscle pain can reinitiate another muscle pain (i.e., the cyclic effect). This clinical phenomenon, was first registered by J.G. Travell *et al*., in 1942 as (cyclic muscle spasm), and later related to the masticatory muscles by Schwartz in 1956.

Another very common symptom, associated with "masticatory muscle pain" was headache attributed to TMJ

The Dysfunction was a regular clinical symptom associated with "masticatory muscle disorders". Frequently it perceived, as a decrease in the range of mandibular motion. When muscle tissues, have compromised by the overuse, any contraction or stretching will increases the pain. Therefore, to maintain comfort, the patient restricts his movement. Clinically this was seen as an inability to open the mouth widely. The restriction may be at any degree of opening depending on where discomfort felt (Edward F and Sarah L., 2009).

The "Acute malocclusion" was another type of dysfunction, refers to any sudden change in the occlusal condition, that caused by a disorder. An "acute malocclusion" might result from alteration in the resting length of a muscle that controls jaw position. When this happens, the patient experience alteration in the "occlusal contact" of the teeth. As slight functional shortening of the inferior lateral pterygoid occurred, disocclusion of the posterior teeth will occur on the ipsilateral side and premature contact of the anterior teeth (especially the canines) on the contralateral side. By functional shortening of the elevator muscles, the patient will generally complain, of an inability to occlude normally (Jeffrey P. Okenson, 2013).

The acute malocclusion was the consequence of the muscle disorder and not the cause. Therefore, treatment shouldn’t directed toward correcting the malocclusion. Rather, it should aimed at eliminating the muscle disorder. When this condition reduced, the occlusal condition will return to normal.

"Myalgia" recognized when pain aggravated by mandibular motion, function, and parafunction. Myalgia further subdivided; into "local myalgia" when pain and palpation tenderness localized to area within muscle. "Myofascial pain with spreading" when palpation cause spreading to other part of muscle and myofascial pain with referral occurred when palpation, cause pain in areas beyond the muscle like ear and eye (Sanjivan Kandasamy, *et al*., 2015).

Other muscle disorder involve "tendonitis" when the pain aggravated by mandibular motion, function, and parafunction, an example was temporalis tendon. While "myositis" was similar to myalgia with infection characteristic, like increase temperature, edema and erythema and directly related to trauma and infection of muscle. "Spasm" on other hand met the criteria of myalgia and the pain and limited motion had immediate onset, "inferior lateral pterygoid spasm" most common in masticatory muscle in which, there was increased pain when mandible translated forward or retruded to the maximum intercuspation (Edward F. Wright, 2014).

B-Disorders of the Temporomandibular Joints

Functional disorders of the TMJs, were probably the most common findings observed in examining a patient for masticatory dysfunction. These findings were due to the high prevalence of signs and not necessarily symptoms. Many of the signs, such as joint sounds, are not painful; therefore, the patient might not seek treatment. However, "functional disorders" generally divided into three broad categories: the derangements of the condyle-disc complex, the structural incompatibility of the articular surfaces, and the inflammatory joint disorders.

The first two categories had collectively referred to as disc-interference disorders. Welden Bell, first introduced the term “disc-interference disorder” in 1970 to describe a category of "functional disorders" that arise from problems with the condyle-disc complex. Some of these problems were due to alteration of the attachment of the disc to the condyle; others from an incompatibility between the articular surfaces of the condyle, disc, and fossa; still others were because the normal structures have been extended beyond their normal range of movement.

The Pain in any joint structure (involving the TMJs) called "arthralgia". It wouldn’t originate from articular joint surfaces, since there is no innervation of the articular surfaces. Hence, "Arthralgia" could therefore, originate only from the nociceptors, located in the soft tissues surrounding the joint.

Three periarticular tissues, involve such nociceptors: the "discal ligaments", "capsular ligaments", and "retrodiscal tissues". When ligaments elongated or the retrodiscal tissues compacted, the nociceptors send out signals and pain perceived. Which, will creates "inhibitory action" in the muscles that move the mandible. Therefore, when pain unexpectedly felt, mandibular movement immediately ceases.

"Arthralgia", in healthy structures of the joint was a sharp, sudden, extreme pain closely associated with joint motion. When the joint rested, the pain resolves rapidly. If the joint structures begun to break down, the inflammation can produce a constant pain, that accentuated by joint movement (Fikácková H *et al*., 2006).

The Dysfunction was common with disorders of the TMJ. Usually it presents as a disruption of the normal condyle-disc movement, with the production of joint sounds. The joint sounds might a single event of short duration known as "clicks". If such a click was loud, it referred to as "pop". Crepitation of joint a multiple, rough, gravel-like sound described as grating and complicated (N. Guler *et al*., 2003).

Derangements of the condyle-disc complex

These disorders present as "series of conditions", most of which might be viewed as a range of progressive events. They arise, because the relationship between the articular disc and the condyle altered. The disc laterally and medially bound to the condyle by, the "discal collateral ligaments"; thus, the translatory movement in the joint, can occur only between the condyle-disc complex and the articular fossa. The only physiological movement that could occur between the condyle and the articular disc was rotation (Kandasamy, S *et al*., 2015).

When the "mouth opened" and the condyle moved forward, the disc rotated posteriorly over the condyle. The superior retrodiscal lamina lengthened, allowing the condyle-disc complex to translate out of the mandibular fossa.

The "superior retrodiscal lamina" was the only structure that can retract the disc posteriorly. This force, however, can applied only when the condyle translated forward, unfolding and stretching the "superior retrodiscal lamina". (In the closed joint position, there was no tension in the superior retrodiscal lamina.) The disc can rotated forward by action of the "superior lateral pterygoid", to which it attached. In the healthy joint, the surfaces of the articular fossa, disc, and were smooth and greasy, allowing easy, frictionless motion (Axel Bumann and Ulrich Lotzmann 2002).

The disc consequently, maintains its position on the condyle during movement because of "disc morphology" and "interarticular pressure". Its morphology (the thicker anterior and posterior borders) provides the self-positioning feature that, in combination with the interarticular pressure, centered it on the condyle. Supporting this self-positioning feature were the medial and lateral discal collateral ligaments, which will not permit the sliding movements of the disc on the condyle. If the morphology of the disk altered, and the discal ligaments elongated, the disc permitted to slide (translate) across the articular surface of the condyle. This type of movement was not present in the healthy joint (David K. L. Tay, 1987).

The "TMJ ligaments" cannot stretched. They made of collagenous fibers that have certain length. "Ligaments" limited the border movements of the joint. Stretch denotes extension, followed by a return to the novel length. The "Ligaments" do not had elasticity; therefore, once elongated, they remain at that length. Once "ligaments" elongated, the biomechanics, of the joint frequently altered (often permanently).

If, the "discal ligaments" elongated, in closed joint position and during function, the interarticular pressure would allow the disc, to position itself on the condyle and no, symptoms noted. However, if the "morphology of the disc" altered—such as a thinning of the posterior border, accompanied by elongation of the discal ligaments—changes, in the normal function of the disc could occur. In the resting closed joint position, the interarticular pressure is very low. If the discal ligaments elongated, the disc was free to move, on the articular surface of the condyle. Subsequently, in the closed joint position, the superior retrodiscal lamina does not provide abundant influence on disc position, tonicity of the "superior lateral pterygoid muscle" will encourage the disc to undertake a more forward site on the condyle (Jeffrey P. Okenson, 2013).

The "forward movement" of the disc limited by the length of the discal ligaments, and the thickness of the posterior border of the disc. The attachment of the "superior lateral pterygoid" pulls the disc not only forward, but also medial to the condyle. If the attraction of this muscle sustained, the posterior border of the disk became thin. As this area thinned, the disc might displaced more in the (anteromedial direction). Since the "superior retrodiscal lamina", provides little resistance in the closed joint position, the medial and anterior position of the disc preserved.

That condition known as "*functional disc displacement*" (Figure 1-24). Most people report "functional displacements of the disc" initially as a shortly altered sensation during movement, but usually without pain. Pain experienced, when the person bites and activates the superior lateral pterygoid. As this muscle pulls, the disc displaced further, and tightness in the previously "elongated discal ligament", produce joint pain.

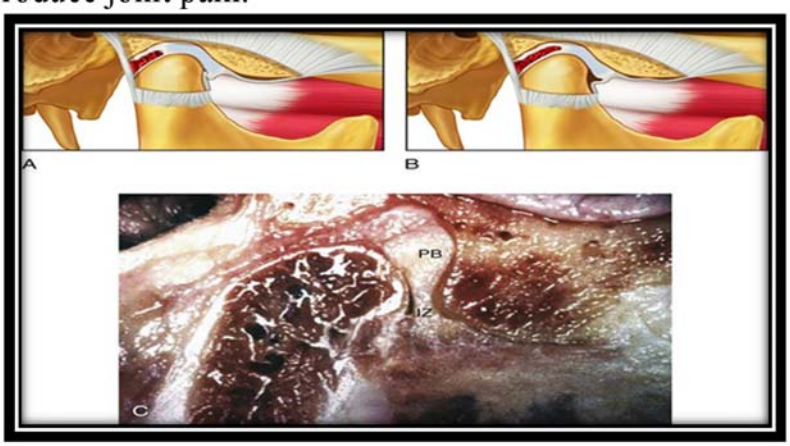


Figure 1-24 A, Normal position of the disc on the condyle in the closed-joint position. B, Functional displacement of the disc. Its posterior border thinned and the discal and inferior retrodiscal ligaments elongated, allowing activity of the superior lateral pterygoid to displace the disc anteriorly and medially. C, the condyle is articulating on the posterior band of the disc (PB) and not on the intermediate zone (IZ). This depicts an anterior displacement of the disc.

As the mouth opened, and the condyle moved forward, a short translatory movement can occur between the condyle and the disc, until the condyle once again assumes its normal position on the thinnest area of the disc (intermediate zone). Once it had translated over the posterior surface of the disc to the intermediate zone, interarticular pressure maintains this relationship, and the disc again carried forward with the condyle, through the remaining portion of the "translatory movement" (Sharmila devi Devaraj and Pradeep D, 2014).

In the "closed joint position", the presence of muscle tonicity will again encourage the disc to undertake the most anteromedial position, allowed by the discal attachments and its morphology. If "muscle hyperactivity" present, the superior lateral pterygoid would have an even greater influence, on the disc position.

The "clicking sound" often accompanies this movement. Once the joint clicked, the normal relationship, of the disk and condyle reestablished, and that relationship maintained, during the rest of the opening movement. Once the mouth closed and the interarticular pressure lowered, the disc again displaced forward by tonicity, of the superior lateral pterygoid. This single click observed during opening movement represents, the very early stages of disc derangement disorder or what also called "internal derangement".

If that condition persists, a second stage of derangement noted. As the disc more repositioned forward and medially by the muscle action of the superior lateral pterygoid, the "discal ligaments are further elongated". Continued forward positioning of the disc causes elongation of the inferior retrodiscal lamina. This breakdown involved a continued thinning of the posterior border of the disk, which permits the "disc" to be repositioned more anteriorly, so that the "condyle" positioned more posteriorly on the posterior border of disc (N. Guler *et al*, 2003).

The morphologic changes, of the disk at the area where the condyle rests could create a second click during the later stages of condylar return, just preceding to the closed joint position. This stage of derangement called the "reciprocal click" (W.B. Farrar and W.L. McCarty, 1979).

The "opening click" could occur at any time during that movement depending on disk-condyle morphology, muscle tonicity, and the pull of the superior retrodiscal lamina. The "closing click" usually occurs very near, the closed or intercuspal position.

T.M. Wilkinson in 1988 suggest that the "superior lateral pterygoid muscle" was not the major influencing factor on the anterior medial displacement of the disc. Although this appear to be the clear influencing factor, other features definitely must considered.

Tanaka in 1989 suggest that the "displaced disc" commonly located anteromedially. This was likely due to the directional forces of the "superior lateral pterygoid muscle" on the disc. However, the disc could displaced only anteriorly or, in a few cases, even laterally. Moreover, the entire disc might not displaced to the similar degree. In some instances, only the medial aspect of the disc, displaced with the remaining portion, preserved in its normal position.

In another instance, only the lateral portion of the disc may displaced. Therefore, it was sometimes difficult to determine the exact position of the disc clinically because the joint sounds might quite different. When this occurs, a soft tissue image (obtained by magnetic resonance imaging) might needed, to determine the definite position of the disc.

The longer the disc displaced anteriorly and medially, the greater the thinning of its posterior border, and the more the "lateral discal ligament" and "inferior retrodiscal lamina" will be elongated (H.U. Luder et al, 1993).

When the posterior border of the disk became thin, the functional attachment of the "superior lateral pterygoid" can encourage an anterior movement of the disc completely, through the discal space. Then, interarticular pressure will collapse the discal space, driving the disc in the forward position. Then the next translation of the condyle repressed, by the anterior and medial position of the disc. The individual then senses the joint being "locked" in a limited closed position. Since the articular surfaces have separated, this condition referred to as "a functional dislocation of the disc". The functionally displaced disc can create joint sounds as the condyle slides across the disc, during normal translation of the mandible. If the disc became "functionally dislocated", the joint sounds eliminated, since no sliding can occur. This can be helpful information in distinguishing a functional displacement from a functional dislocation.

Some individuals with a "functional dislocation of the disc" were able to move the mandible in lateral or protrusive directions to accommodate the condyle over the posterior border of the disk, thus the "locked condition" resolved. If the lock occurs infrequently, and the individual can resolve it without assistance, it referred to as a "functional dislocation with reduction". That condition may or may not be hurting, depending on the severity and duration of the lock, and the integrity of the structures in the joint. If the condition was acute, having a short history and duration, joint pain may be associated with elongation of the joint ligaments. As episodes of catching or locking become more frequent and chronic, "the ligaments" break down and the innervation lost. Pain became less associated with ligaments and more related to the forces placed on the "retrodiscal tissues".

The next stage, of disc derangement known as "functional disc dislocation without reduction". This occurs when the individual unable to returned the dislocated disc to its "normal location" on the condyle. The mouth cannot opened maximally, because the disc does not allow "full translation" of the condyle.

The initial opening will be only (25 to 30 mm) intrinsically, which represents the maximal rotation of the joint. Since only one joint usually became lock. The joint with the functionally "dislocated disc without reduction" did not allow complete translation of its condyle, whereas the other joint functions normally. Therefore, when the patient opens wide, the midline of the mandible deflected to the affected side. In addition, the patient able to perform "a normal lateral movement" to the affected side (only the condyle on the affected side rotates). However, when movement is attempted to the unaffected side, a restriction develops (the condyle on the affected side could not translate)(Jeffrey P. okenson, 2013).

The dislocation without reduction had termed a (closed lock), since the patient feels locked near the "closed-mouth position".pain reported, when the mandible moved to the point of limitation, but not necessarily (R.W. Katzberg, et al., 1996).

If the (closed lock) continues, the condyle will chronically positioned on the retrodiscal tissues. These tissues not structured to accept force (Figure 1-31). Therefore, as force is applied, the tissues might break down (A.B. Holumlund, *et al*., 1992). With this breakdown came tissue inflammation.

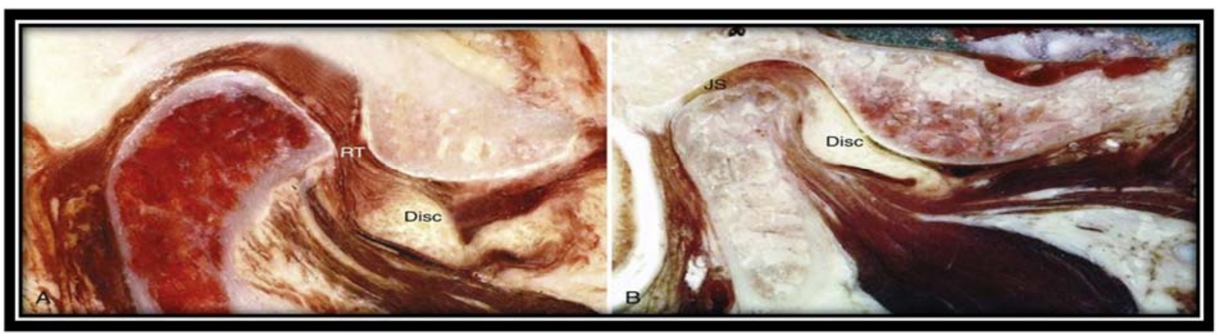


Figure (1-25) In this specimen there is a functionally anterior dislocated disc and the condyle is totally articulating in the retrodiscal tissues (RT). B, The specimen also has an anterior dislocated disc. The condyle has moved closer to the fossa as the joint space (JS) has narrowed.

C- Joint Inflammatory disorder

Inflammatory joint disorders, were a group of disorders in which various tissues that made up the joint structure become "inflamed", because of insult or breakdown. Some or all of the joint structures might be involved. Disorders of this categoryو were capsulitis, synovitis, Retrodiscitis, and the Arthritides. Dissimilar to disk derangement disorders, in which the pain often momentary and associated with joint motion, "inflammatory disorders" were characterized by a constant dull, aching pain that is intensified by joint motion (A.B. Holmlund *et al*. 1992).

Synovitis

When the synovial tissues of the joint become inflamed, the condition called "synovitis". This disorder characterized by constant intracapsular pain that intensified by joint movement. "Synovitis" commonly caused by irritating condition within the joint. It may result from unusual function or trauma. It was difficult clinically to differentiate "inflammatory disorders" from each other because the clinical presentations very similar. For example, synovitis and capsulitis are nearly impossible to separate clinically (G.W. Gynther ET AL, 1994).

Capsulitis

Once the "capsular ligament" becomes inflamed, the condition called "capsulitis". It typically presented clinically as tenderness when the lateral pole of the condyle palpated. Capsulitis produced pain even in the static joint position, but the pain, exacerbated by protrusion or lateral excursion of the mandible and mouth opening. Though a number of etiologic factors can contribute to capsulitis, the most common is macrotrauma (especially an open-mouth injury). Thus, whenever the capsular ligament sharply elongated and an inflammatory response detected, it expected that trauma would found in the patient's history. "Capsulitis" also developed, secondary to nearby tissue breakdown and inflammation (Curl DD, and Stanwood G. 1993).

Retrodiscitis

The "Retrodiscal tissues" were highly vascularized and innervated. Thus, they were unable to tolerate much loading force. If the condyle impinges on these tissues, breakdown and inflammation were expected. As with other inflammatory disorders, inflammation of the "retrodiscal tissues" characterized by constant dull, aching pain that was often augmented by clenching. If the inflammation becomes great, swelling might occur and force the condyle somewhat forward down the posterior slope of the "articular eminence". This shift caused "an acute malocclusion". Clinically such "an acute malocclusion" perceived as, disengagement of the ipsilateral posterior teeth and substantial contact of the contralateral canines (A.B. Holmlund et al, 1992).

Trauma was the major "etiologic factor" with "Retrodiscitis". Open-mouth macrotrauma (a blow to the chin) can force the condyle onto the retrodiscal tissues. Microtrauma can also be a factor and was associated with discal displacement. As the disc thinned, and the ligaments become elongated, the condyle begins to intrude on the retrodiscal tissues. The first area of breakdown was the "inferior retrodiscal lamina", which allows more discal displacement. With continued breakdown, disc dislocation arises and forces the entire condyle, to articulate on the "retrodiscal tissues". If the loading great for the retrodiscal tissue, collapse continues and perforation can occur. By perforation of the "retrodiscal tissues", the condyle may ultimately move through tissues, and articulate with the fossa (H.U. Luder *et al*., 1993).

Arthritides

The "Joint Arthritides" represent a group of disorders in which destructive bony changes encountered. One of the common types of TMJ Arthritides called osteoarthritis (degenerative joint disease). "Osteoarthritis" represents a destructive procedure by which the bony articular surfaces of the condyle and fossa became altered. It considered to be, the body's response to increased loading of a joint. As loading forces remain, the articular surface becomes softened (the chondromalacia), and the subarticular bone begins to resorb, finally results in loss of the subchondral cortical layer, bone erosion, and consequent radiographic evidence of "osteoarthritis" (B. Stegenga *et al*., 1991).

The "Osteoarthritis" occasionally painful, and the jaw movement heightens the symptoms. Crepitation (multiple grating joint sounds) was a common finding with this disorder. "Osteoarthritis" could occur anytime the joint overloaded, but mostly associated with disc dislocation or perforation (D.K. Mills *et al*., 1994).

When the disc dislocated, and the retrodiscal tissues break down, the condyle begun to articulate directly with the fossa, thus accelerating the destructive process. In time, the dense fibrous articular surfaces destroyed, and bony changes occur.

Radiographically, the surfaces seem to be eroded and flattened, however these findings, may not reflect the clinical signs and symptoms; "Asymptomatic joints" might existing with radiographic changes, and few of the "symptomatic joints" might fail to show radiographic changes (Priyanka Verma *et al*., 2017).

If patients met, the criteria for diagnosis of degenerative joint disease without tenderness to palpation "osteoarthrosis" had been used, as non-inflammatory form of "osteoarthritis" (Edward F. Wrght, 2014).

1.7 Jaw tracking devices

Mastication or chewing, was one of the vital functions of the stomatognathic system. A "joined neurologic controlling system", controls and coordinates all structural components involved in the procedure.

The use of devices for quantitatively assessing mandibular movement, had become more common, in the dental investigations. Often, the goal has been to provide an objective foundation for diagnosing musculoskeletal disorders of the jaws or to monitor the progress, of active treatment methods (Una Soboļeva, *et al*., 2005).

The degree to which jaw tracking provides a useful research means, a diagnostic aid, or a therapeutic screen, obviously depends on what was being assessed, how the process carried out, and why the information was substantial (Hannam AG, 1992).

Various methods had used to clarify articular movements of study casts mounted in an articulator. However, the validity of these studies was uncertain these involve photographic methods, magnetometery and optoelectronic methods (Una Soboļeva *et al*., 2005).

A pantograph, in dentistry, was an instrument used to graphically record the paths of mandibular motion, and to deliver information for the programming an articulator so that articulator movements will be in coordination with the patient's mandibular movements (McCollum 1955, Stuart 1959, Clayton 1971, Curtis and Sorensen 1986).

The "pantographic tracing" was a graphic record of mandibular motion, typically recorded in the horizontal, frontal and sagittal planes and recorded by styli on the recording tables of the pantograph or by means of electronic sensors (Curtis and Sorensen 1986 and GPT-8 2005).

"Pantography" considered being the most precise and completing means of recording jaw motion and border locations (Clayton 1971 and Lucia 1983). Dental restorations, fabricated on articulators programmed using "Pantography" should function in the patient's mouth, without any interference (Anderson *et al*., 1987).

1.7.1. Mechano-electronic Pantograph

Hobo and Mochizuki in (1983) developed an "electronic calculating system" capable of recording mandibular motion. They established a sensor that could measure in two spatial dimensions. The "styli tips" formed a triangle and connected to the mandible via a clutch. The styli made contact with the sensors. A computer processed the data, and mandibular movement displayed graphically by "graphic plotter".

Celar and Tamaki in (2002) assessed the accuracy of a mechano-electronic device Cadiax Compact® in measuring condylar sets of an articulator. He concluded that the "Mechano-electronic device" was clinically acceptable because of the small mean of differences. "The mechano-electronic device" showed less variability than the mechanical pantograph and was more reliable, than settings obtained from interocclusal records.

Wagner at (2003) compared an optoelectronic (Polaris®) and mechano-electronic (Cadiax®) pantographs. He suggested that the optoelectronic device was less bulky and more convenient during the recordings. He found the precision of the optoelectronic device to be comparable to the Cadiax® device.

Bernhardt *et al*., in (2003) measured the accuracy of (Cadiax Compact®) device to define if there was a significant difference between measurements recorded from a kinematically located "transverse horizontal axis" THA or an arbitrary THA. He found no significant differences between the two procedures.

Chang *et al*., (2004) verified the validity and reliability of "a mechano-electronic device" (Cadiax Compact®) in counting the condylar settings of five different articulators (Denar® D5A, Denar® Mark II, Whip Mix® 8500, Hanau® Modular and Panadent® PCH). They found the "ten-millimeter recording distance", provided the most reliable and valid readings, for the articulators.

O. Schierza *et al*., 2014 claimed that the electronic determination of the sagittal condylar inclination angle using "cadiax compact II" was a reliable procedure when applied in prosthodontic patients using a clutch and tray for fixation.

Subject, Materials and Methods

2.1 The Sample

The study sample, consist of "one hundred patients" with TMJ disorder and twenty control group. Patients with TMJ disorder, distributed into five groups according to, Diagnostic Criteria for Temporomandibular Disorders 2013. *

1- Twenty patients with myalgia.

2- Twenty patients with arthralgia.

3- Twenty patients with headache attributed to TMJ.

4- Twenty patients with intraarticular joint disorders.

5- Twenty patients with degenerative joint disorders.

The study conducted in "College of dentistry Baghdad University" in a period from 1/8/2015 to 1/7/2016. Patients age, range from 25-55 years old. A scientific committee in Baghdad University / college of dentistry as well as Ministry of Health in Iraq granted the ethical approval for this case control study. Moreover, all patients acknowledged about the study, and informed consent obtained from the Patients(Appendix1).

2.1.1 Exclusion criteria

The selection of the patients based on exclusion criteria, describe as the following individuals suffer from the following conditions:

Edentulous patients, patients with "class I-II Kennedy classification" patients with parathyroid gland disease, patients with neoplastic disease, and patients with "developmental disorders" of the TMJ such as condylar aplasia, hypoplasia, or hyperplasia; were not considered for this study.

*** Diagnostic Criteria for Temporomandibular Disorders (DC/TMD) Clinical Examination Protocol.**

2.2 Material and equipment

2.2.1 Instruments used for oral examination of patients

1- Disposable kit for diagnosis.

2- Metal ruler.

3- Pencil.

2.2.2 Equipment

1- Bite registration polyvinyl siloxane.

2- Cadiax compact II GAMMA Medizinisch-wissenschaftliche Fortbildungs.

3- Toshiba aquilion 64-slice CT scanner

4- Philips Achieva 3.0T TX, MRI system.

2.3 Methods

2.3.1 Questionnaire

Questionnaire contained the information present in(Appendix2).

2.3.2 Oral examination

All the patients examined by "a single examiner", under standardized conditions; the oral cavity examined in an artificial light by using, a mouth mirror.

The method of examination, of "oral soft tissue" was done in sequence according to directions that suggested by the W.H.O.(1987),the examination initiated with the [lip ,upper and lower sulcus, retro-molar area ,upper and lower labial mucosa , buccal mucosa ,then the hard and soft palate, dorsal, margins and inferior surface of tongue ,floor of the mouth] were also observed.

2.3.3 Temporomandibular joint examination procedure

2.3.3.1 Pain assessment: A verbal rating scale, used for pain assessment for patients with TMJ disorders figure (2-1) contains "a series of adjectives" reflecting degrees of pain severity, arranged from ‘‘no pain’’ to whatever term or phrase was used to label, the utmost extreme pain (Marcel Dijkers, 2010).

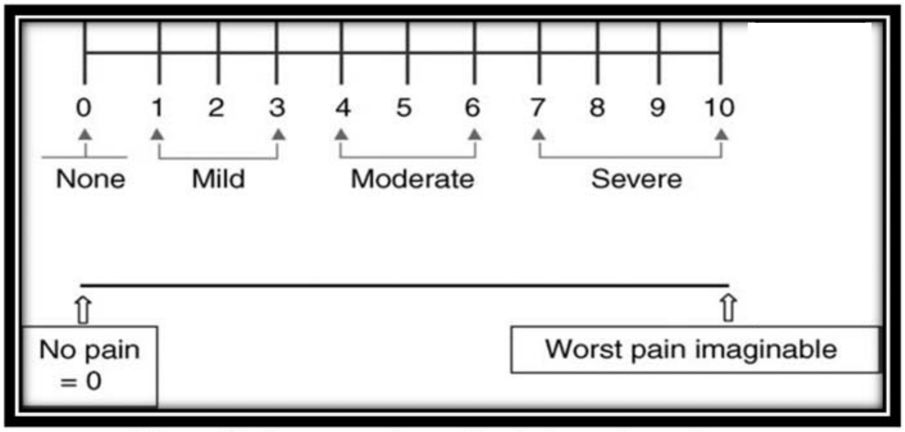


Figure (2-1) commonly used pain intensity scales

2.3.3.2 Patient positioning. The patient was sitting "securely upright" in a chair, which could adjusted for height. The patient position, in the chair should adjusted for utmost comfort for both the patient and the examiner.

2.3.3.3 Examiner positioning. The examiner was standing to the" patient’s right" and fronting the patient. This position, permits the examiner to execute the "full examination" using each hand as necessary, while the other hand used, to stabilize the patient’s head or the mandible. If alterations in this "basic arrangement" of patient sitting upright and examiner standing to the patient’s right are desired (e.g., a patient had a medical situation, and needs to sit in a reclined chair), the examiner would need to modify "his/her position" relative to the patient, possibly to sit behind that patient. All the sided- instructions should be adapted consequently.

2.3.3.4 Examiner Confirmation of Pain and Headache Location

A- Examiner Instructions of Locations for Pain Reporting

The Patients classically described in the "pain history" the location of symptoms in anatomical positions (e.g., “TMJ”, “joint”). The examiner, still, must name the symptom location, by identification of "anatomical landmarks". This first step, of the examination orients the patient to the regions of concern, followed by the examiner approving the "anatomical structures", related with the areas of pain complaint.

The Areas were touched in order from left to right: the temporalis, the TMJ, the masseter, and the posterior and sub-mandibular areas. Both sides were touched at the similar time. For the temporalis and the masseter muscles, the ventral sides of the fingers, contacted the entire muscle.

Patient was educated to point with one finger, to all of the areas of pain; on occasion, the patients might use "an entire hand". It clarified if patient intended to point to the whole area.

The area(s) were touched and the patient indicated feeling pain in order to (1) confirm that the touched area, was what the patient intended, and (2) identify concurrently the structure (e.g., muscle, joint).

B- Familiar Headache Pain.

The patients asked, if he had a recent history of headache. If the patient was positive for history of (temporal-area headache), then it must be determined if the procedure-induced pain, replicates the patient’s (temporal area headache). By asking the patient, “When you opened your mouth broadly and it was painful, was that pain similar your headache in this part of your head?” or "When I pressed on the area, was that pain similar "your headache", in this portion of your head?

C- Incisal Relationships

The maxillary and mandibular incisors, aided as "stable landmarks" for dependable measurements, of mandibular range of movement, in vertical as well as horizontal planes of movement.

Reference Lines

The Maxillary reference tooth, had selected. A horizontal line drawn on the labial surface of the opposing mandibular incisor, using the incisal edges of the maxillary incisor, as the guide. The pencil mark, assured to level with the maxillary incisal edge, figure (2-2).

Figure (2-2) overbite line

The "mesial-incisal edge" of the maxillary central incisor was within 1.0 mm of being in line with the mandibular incisal midline; these midlines were "satisfactory landmarks" for lateral excursive measurements, figure (2-3).

Figure (2-3) The midline

If "Mesial-incisal edge" of the maxillary central incisor was, further than 1.0mm away from the "mandibular incisal midline". A corresponding vertical line, had drawn from the maxillary midline down the opposing mandibular incisor; figure (2-4).

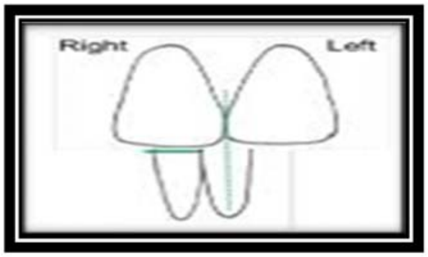


Figure (2-4) the maxillary midline is more than 1mm away from mand. Midline

An Alternative technique for creating "midline reference lines": was a vertical line drawn through the face of the "maxillary reference incisor" and down onto the opposing mandibular incisor, figure (2-5).

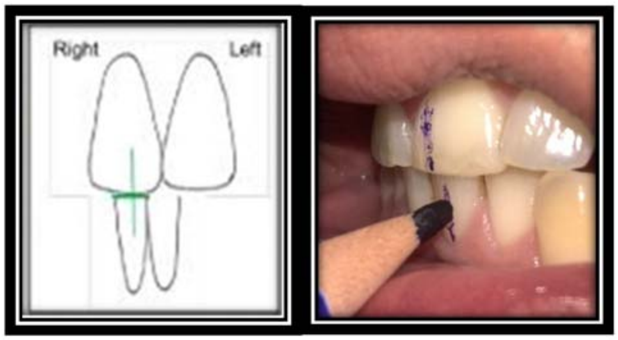


Figure (2-5) Alternative midline reference lines

The Magnitude of "horizontal overlap" measured. The ruler was contacting the mesial-distal center of the maxillary central incisor. If an incisor rotated, the contact location with the incisor, influenced the measured "horizontal overlap", figure (2-6).

Figure (2-6) Horizontal overlap

The Extent of "vertical overlap" measured. The tip of ruler placed adjacent to the incisal edge, and the distance to the horizontal line was read. Alternatively, especially if the "lower lip" obstructs with ruler placement, the ruler tip placed at the line, with the ruler extending toward the" maxilla", and the distance to the mandibular incisal edge was read, figure (2-7). All the measures were round down, to the closest mm.

Figure (2-7) vertical overlap

D- Opening Pattern

The test had apparent utility for diagnosis of "disk displacement without reduction with limitation", and for less common diagnoses (for example, the muscle contractures). The primary purpose, for holding the test on a routine basis, however, was that it served as a useful “warm-up” practice for the patient before requesting the patient to execute, the opening mobility movements, which were measured.

Figure (2-8) Reference midline

The "Opening pattern" assessed with or without any reference lines. A ruler placed against the end of the maxillary central incisor; that the edge of the ruler is about 2mm from the mesial incisal edge of the right central incisor; figure (2-8). Because the lower lip deviated to the patient’s left, it might appears that the mandible deviated to the left; however. Since the "mandibular midline" was within 2 mm of the maxillary midline and because the mandible opened along the path illustrated by the ruler, this was "a straight opening pattern".

If the mandibular midline had moved more than (2mm) to the patient’s right during opening, this would classified as "an uncorrected deviation" figure, (2-9).

If Mandible deviates to the right side, more than (2mm) from the midline, and returned to the midline zone (within the 4mm zone). This would be classified as "an corrected deviation"

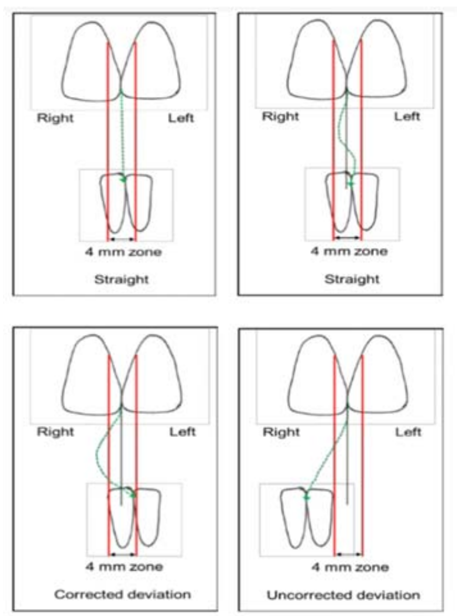


Figure (2-9) Type of deviations

E- Open Movements

The "Mobility testing" addresses a fundamental sign of TMD, considered one of the most reliable clinical procedures, and was a clinically appropriate outcome measure.

The Measurements were taken between the incisal edges of the maxillary and mandibular reference teeth two type of opening movement were considered in this study; the Maximum Unassisted Opening and the Maximum Assisted Opening.

1- Maximum Unassisted Opening

The tip of the ruler positioned against the incisal edge of the "mandibular reference incisor", and the distance to the mesial-distal center of the edge of the maxillary central incisor read, and patient requested to open, as wide as possible, even if painful, figure (2-10).

Figure (2-10) Maximum unassisted opening

2- Maximum Assisted Opening

The ruler first placed in position and after insuring that the patient opened to the same extent, as during the prior "Maximum Unassisted Opening", the fingers were placed in the scissors-position and the examiner then stretches the mouth to further open, if possible, figure (2-11).

If patient asked to stop the procedure, then Opening Terminated and recorded as “yes”. Otherwise, it recorded as “no”.

Figure (2-11) Maximum assisted opening

Patient asked to point to any area of pain, experienced with this movement.

The area touched to confirm underlying structure, and then asked if that pain was “familiar”.

F- Lateral & Protrusive Movements

Excursive movements complement open movements for complete assessment of jaw mobility. These measurements are complementary and might omitted.

The rationale for measuring the "lateral movements" was to document the extent of the excursive movements and any movement that induced pain. Moreover, in certain situations, measurement of excursive movements serves to document if condylar movement was "restricted versus normal".

Right Lateral Excursion

The Ruler placed in horizontal position with tip at the "mandibular midline" reference position. Patient moved mandible to right while lip retracted, as necessary with other hand, figure (2-12).

Figure (2-12) Right lateral excursion

The Patient asked to point to any area(s) of pain, as necessary, the area touched to confirm the underlying structure.

Left Lateral Excursion

The Ruler placed in horizontal position, with tip at the "maxillary midline" reference position. Patient moved mandible to left while the lip retracted, as necessary with other hand; figure (1-13).

Figure (2-13) Left lateral excursion

Protrusion

The ruler placed in horizontal location, with tip on the buccal surface of the maxillary reference tooth. Patient moved the mandible in protrusive direction while the lip retracted, as necessary with other hand; figure (2-14).

Ruler held with face of the ruler directed upward; (right) ruler held with face of the ruler directed to the side. In this situation, holding the ruler as was generally better since the measurement can read downward from ruler to mandibular incisal edge.

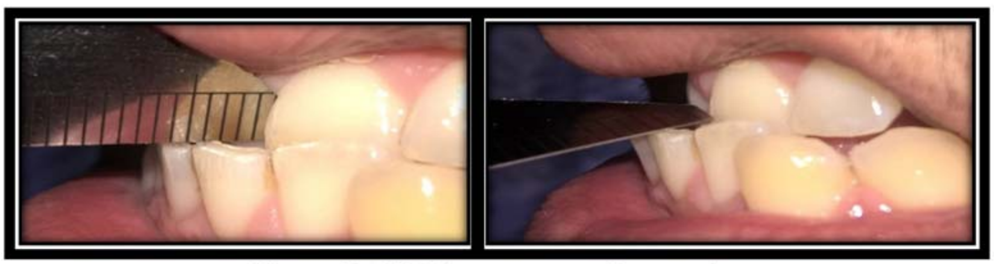


Figure (2-14) Measurement of protrusion

Alternative Measurement Method for Lateral Excursion

Right and Left Lateral Excursions

If the "alternative vertical reference" marks used, then lateral excursions measured as the ruler held further away (inferior) from the maxillary incisal edge.

Ruler placed in "horizontal location" with tip at the "mandibular midline reference position", as designated by the vertical line on the mandibular incisor. Patient moved mandible to right while the lip retracted, as necessary with other hand, figure (2-15).

Figure (2-15) Measurement of excursion alternate methods

The Ruler placed in horizontal position with tip consistent to the line on the "maxillary reference incisor". Patient moved mandible to the left, the lip retracted as necessary, and the ruler read.

G- TMJ Noises during Open & Close Movements

The "TMJ noises" were a standard sign associated with TMD. Because patients are often disturbed about joint noises, the assessment of TMJ noise remains a portion of the clinical examination. The TMJ usually examined in one of two ways

Each TMJ "examined independently": one fingertip, place on the skin overlying the right TMJ, and the other hand used to stabilize the head.

Each "TMJ examined simultaneously": one fingertip, from each hand placed on the skin overlying the respective TMJs.

While palpating the joint, the patient asked to open and close. The left tempromandibular joint, would be examined in the same manner.

G- TMJ Noises during Lateral & Protrusive Movements

This test was an extension, of the assessment of TMJ noises during the opening and closing movements.

The "right TMJ" examined while the mandible was moved to the right, to the left, and protrusively. The "left TMJ" examined in the same manner.

I-Joint Locking

"Joint locking" in the clinic, was uncommon but it did occur. Documenting whether "locking" occured or not was a useful task within the examination. Given the related pain, disability, and the treatment complexity that could be associated with joint locking.

During any portion of the examination, if no open or closed locking happened, then the examination form marked to indicate that neither type of "locking" occurred. If "locking" arose, again during any part of the examination, then on the examination form indicated when the "locking" occurred (during the opening movement, or at maximal opening) as well as whether the patient reduced the lock or the patient assisted in reducing the lock.

I- Muscle and TMJ Pain with Palpation

The Pain induced in muscles via palpation was a classic clinical investigation. The intent was, to determine if the patient reports pain from palpation of a muscle or joint, and determine if any induced pain replicates or duplicates the patient's pain complaint. Several approaches were available, depending on the purpose of the examination.

Extra-oral masticatory muscles: the "temporalis and masseter". The Illustration demonstrates palpation pathways for temporalis and masseter muscles, and with three palpation areas per zone, figure (2-16). The goal was to palpate each zone as totally as possible, so the three areas palpated within each zone using (1 kg) of pressure.

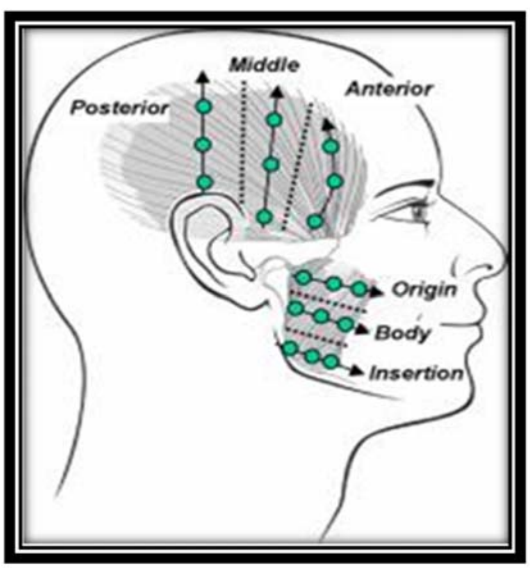


Figure (2-16) Extra oral masticatory muscles: Temporalis and masseter muscle

The DC/TMD examination form (appendix 1) within this protocol provides a recording field for each, of the three bands of muscle. The use of zones for palpation recommended, because such usage enhances the "systematic coverage" of the muscle during the palpation examination.

Temporalis (1 kg of pressure)

Started with the "anterior zone" (posterior to the bony margin of the anterior temporalis): the area directly above the zygomatic arch palpated, and continues within the zone, until the superior boundary of the muscle touched. A middle area of the anterior zone palpated.

"Middle zone" (in front of the ear): the area above the zygomatic arch, and continues until the superior boundary of the muscle reached.

"Posterior zone" (in line with the top of the ear): started immediately, above the ear and continued until the superior boundary of the muscle, reached, figure (2-17).

Figure (2-17) Temporalis (1 kg of palpation pressure)

Masseter

The zones of palpation for the three areas of the "masseter muscle" involved; superior, middle, and inferior.

Figure (2-18) Masseter (1 kg of palpation pressure)

Palpation sequence for the "masseter muscle" involve (while the other hand stabilizes the mandible), the "Origin zone" (inferior to the bony margin of the zygomatic process): started at the area just anterior to the condyle.

The "Body zone" (in front of ear lobe): started at the most posterior aspect of the muscle. The "Insertion zone" at the area anterior and superior to the mandible angle, in each zone the palpation continued until the anterior border of the muscle, reached; figure (2-18).

Temporomandibular Joint

TMJ lateral pole (0.5 kg of palpation pressure)

The Target area for "lateral pole" palpation of the TMJ, one finger used, and one joint was palpated at each time; the other hand used to stabilize the head. The mouth remains closed. (0.5 kg) pressure used; figure (2-19).

Figure (2-19) Lateral pole palpation with one figure

Dynamic TMJ lateral pole palpation (1 kg of palpation pressure)

The condyle Protruded to the forward position, as indicated by solid white line, sufficient to allow, access for palpation of the dorsal aspect of the "condylar head". The Dashed white line, corresponds to closed condylar position; figure (2-20).

Figure (2-20) Dynamic TMJ palpation

The lateral pole, identified after the mandible sufficiently protruded. The "filled green dot" indicates the position of the finger at the posterior aspect of the lateral pole; the starting point, for the finger which rolled first anteriorly and superiorly around the superior circumference of the "lateral pole". The finger continued around the condyle, whereas maintaining the contact with the circumferential aspect of the lateral pole, and the circular movement continued, until the finger returned to the dorsal portion, of the lateral pole figure, (2-21).

Figure (2-21) dynamic lateral pole palpation

J- Supplemental Muscles Palpation Areas (0.5 kg palpation pressure)

Posterior and submandibular masticatory muscle areas

The Patient extends head anteriorly, in order to open the space posterior and medial to the "posterior border of the mandible". The finger placed in the space that opened, and pressed (anteriorly and medially).

Then Finger placed on the "medial aspect" of the inferior border of the mandible, with force directed superiorly and laterally (i.e., against the medial wall of the mandible). The patient could asked to retract head and drop the chin, in order to allow the palpating finger to move as described.

Lateral Pterygoid Area

The Finger placed in upper vestibule while mandible is deviated to the same side. The most; "medial, superior, and posterior area" in the vestibule palpated, figure (2-22).

Figure (2-22) Lateral pterygoid muscle palpation

Temporalis Tendon

The Finger placed against the "ascending ramus" while the mandible was slightly open, and the finger moved, superiorly as far as possible, while maintained contact with the underlying hard surface; figure (2-23).

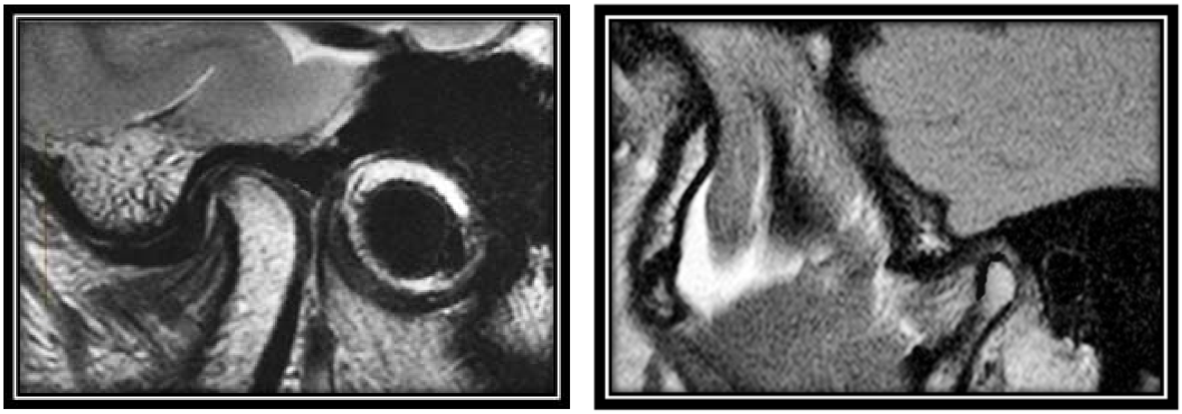
Figure (2-23) Tendon of Temporalis palpation

After examination finalized the diagnosis confirmed according to (appendix 3).

2.3.4 Magnetic resonance image

Twenty patients were clinically diagnosed to have intraarticular disc disorder, attend Al _Yarmouk teaching hospital and Al _ Nejatt privet Radiology clinic and had MRI image using Achieva 3.0 T TX Philips, report of radiologist reviewed by supervisor and accredited in result figure (2-24).

The "normal disc position" in closed mouth defined by, that posterior border of the articular disc was located above the apex of the condylar head (12 o'clock position) in the intercuspal position (Mahrokh Imanimoghaddam *et al.*, 2014).

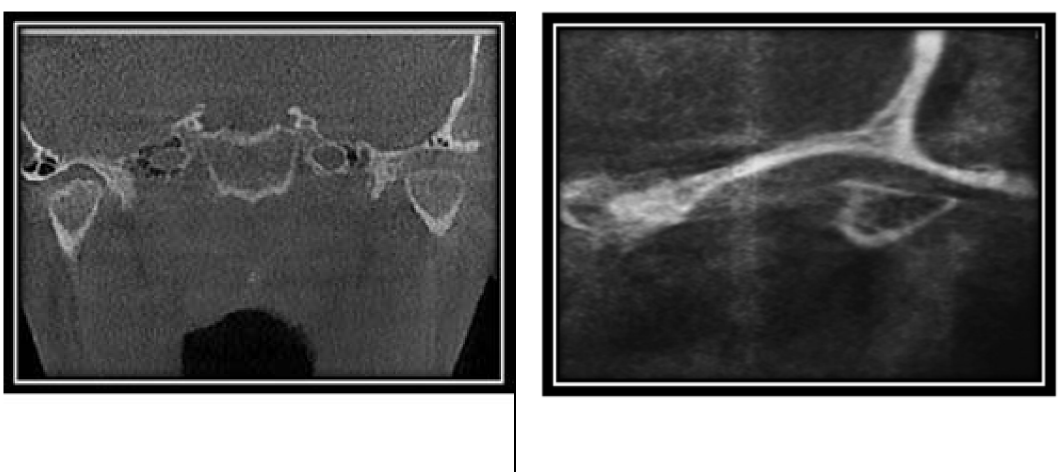


A B

Figure (2-24) MRI image, A-anterior disc displacement B- normal disc position

2.3.5Computerized Tomography

Twenty patients were clinically diagnosed to have "degenerative joint disorder", attend Institute of Radiology in medical city and had CT scan image using Toshiba CT scanner aquilion 64, report of radiologist reviewed by supervisor and accredited in result figure (2-25).



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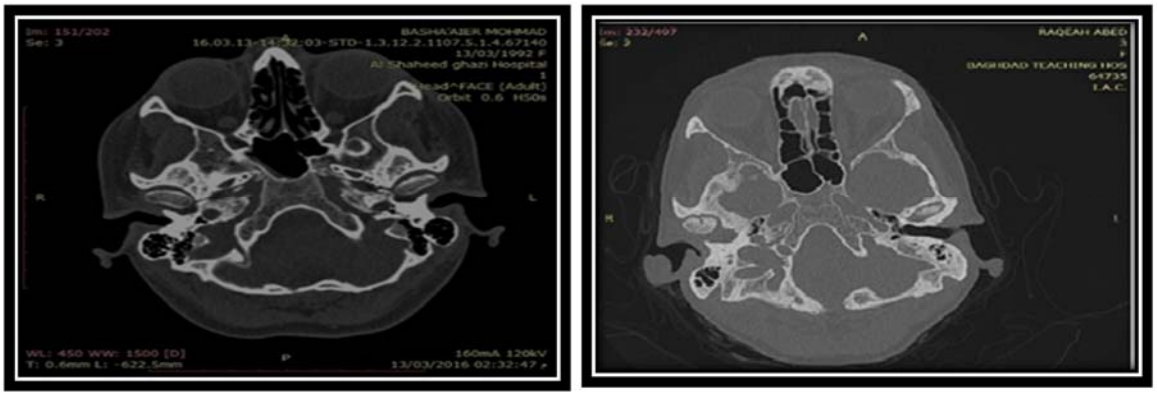


C D

E

Figure (2-25) CT images for patients with degenerative joint disease A- osteophyte formation B- flattening C- erosion D- subchondral thickening E- narrowing

2.3.6 Cadiax compact II

2.3.6.1 Cadiax device component

1- Cadiax compact device by Gamma Medizinisch-wissenschaftliche Fortbildungs

2- USB cable

3- Strap

4- Foot switch

5- Cadiax compact II recorder software package

6- Anatomic face (upper face bow) bow with retention straps

7- Mandibular bow (lower face bow)

8- 3D joint support

9- Bite fork support

10- Bite fork

11- Occlusal clutch

12- Flange

13- Styli

14- Hinge axis locator pins as shown in figure (2-26).

Figure (2-26) Cadiax compact II

2.3.6.2 Setting up the cadiax device

The computer connected to "cadiax device" in the proximity of the patient, the patient proximity define, as the area which the patient, could intentionally or unintentionally came in contact with the device.

Operating the cadiax device

The Switching of recording mode, done only after the measuring sensors (flags and styli) were completely mounted.

The sensors, should not be touched during registration, not by either operator nor by the patients.

Start up the "Cadiax compact II" Software on computer and the "Cadiax compact II" connected to computer. Next, the patient data entered. There were input fields available, above the coordinates system, for given [name, family name, date of birth, and gender].

Then occlusal try, mounted the on the lower jaw with Bite registration "polyvinyl siloxane", then fix the upper and lower face bow to the patient with the measuring styli and flag, then started the recording of the curves. The recordings, will be made with the patient sitting in an upright position, head supported. The lower facebow, attached to the mandible with an occlusal clutch, to allow registration of "occlusal positions" without any interference figure (2-27).

The patient brought into the "reference position" with unforced chin point guidance. The coordinates, of this position recorded. Excursive movements, made from this reference position. All movements, carried out three times.

The patient asked to carry out the movement, which were the protrusive movement, the "mediotrusion movement to the left" and the "mediotrusion to the right" side and opening and closing movement.

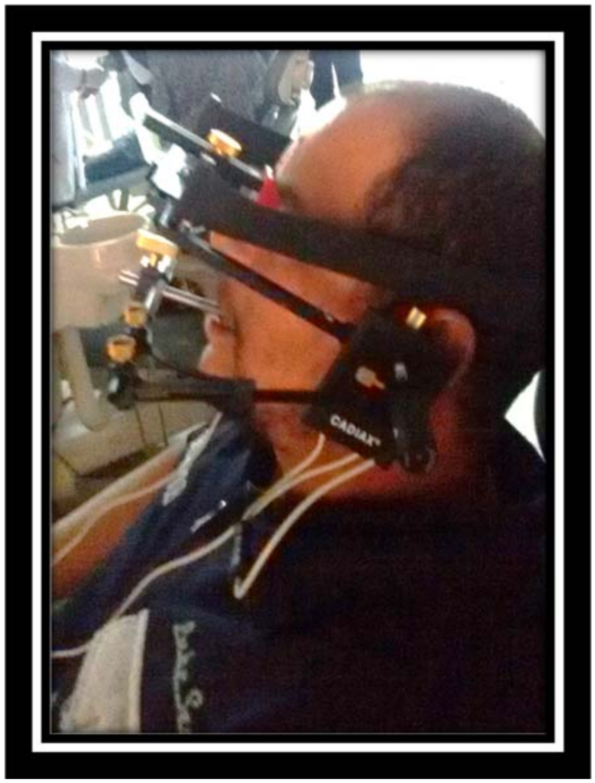


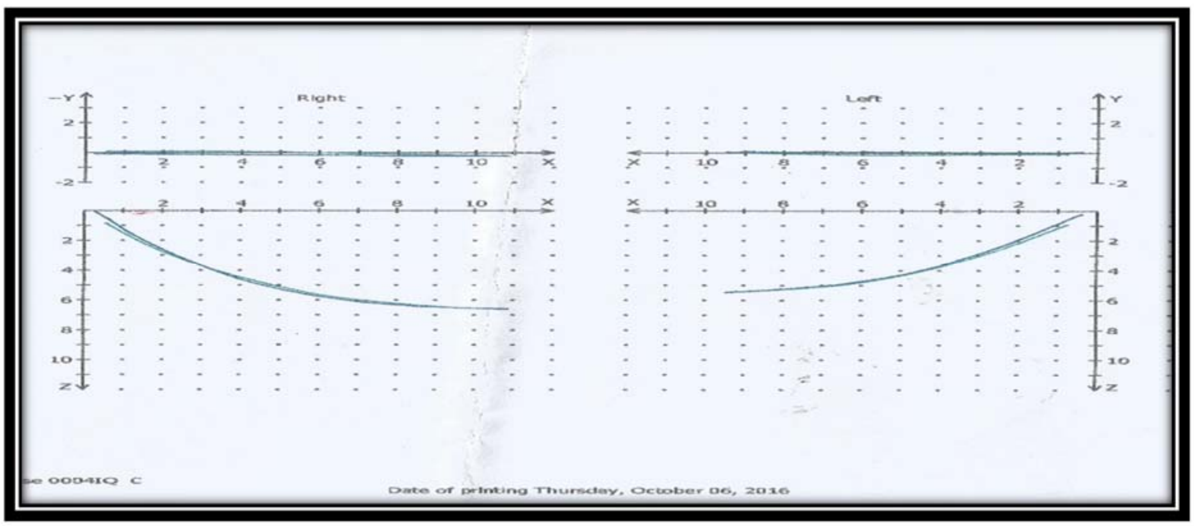
Figure (2- 27) Mounting of "Cadiax compact II

2.3.6.3Cadiax® curve recorder

The results were display in "Cadiax® recorded windows", the graph in the left, upper part of window designated the (Bennett movement) of right condyle (on the screen, the X- axis was horizontal, the Y- axis was vertical). The graph under it showed the sagittal level, sub divided by points a millimeter apart (on the screen the X- axis was horizontal, the Z-axis was vertical).

The graph in the right, upper part of window designated the (Bennett movement) of left condyle (on the screen, the X- axis was horizontal, the Y- axis was vertical). The graph under it showed the sagittal level, sub divided by points a millimeter apart (on the screen the X- axis was horizontal, the Z-axis was vertical). Figure (2-28).

The origin, for all of the graphs was "reference position" (RP) which was determined by defining axis. The curves did not always match with origin of coordinate system. The sagittal charts, correspond to squares with length of 10 mm. The "Axiograph curves" were not limited to these lengths.



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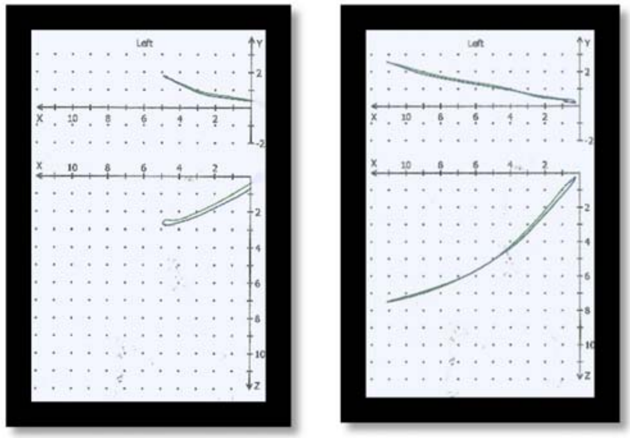


B

Figure (2-28) Cadiax curves A- protrusion (control) B mediotrusion Right (control and patient).

The upper section of both "Bennett coordinate systems" were oriented toward the medial. The "sagittal coordinate systems" were oriented towered the front and point to the middle of screen.

2.3.6.4 Articulator setting

The "Cadiax® system" supports different articulator brands to program the patient setting for the condylar housings.

The Denar® Mark II had been chosen, the program displays the following diagrams.

The "first diagram" showed values, which had used for calculation. The "second diagrams" showed the transversal condylar track guidance, the "third diagram" showed the calculation of sagittal condylar guidance; figure (2-29).

Remarks:

Articulator: Denar® Mark II

CADIAX® Curves

	Protrusion		Mediotrusion right		Mediotrusion left	
	SCI right	SCI left	S C I	T C I	S C I	T C I
1st	13.7°	13.7°	49.4°	15.5°	39.8°	17.0°
2nd	30.5°	27.4°	55.1°	−14.4°	43.7°	−8.0°
3rd	35.5°	32.2°	53.1°	−6.9°	43.7°	−6.5°
4th	36.9°	35.0°			44.0°	−0.8°
5th	36.8°	36.5°			44.0°	6.3°
6th	35.8°	37.6°				
8th	30.4°	37.4°				
10th						
14th						
	Retrusion					
-1.						
-2.						

Sagittal Condylar Guidance Denar® Mark II

Right			Left		
3rd mm	5th mm	10th mm	3rd mm	5th mm	10th mm
31°	35°		27°	33°	

Transversal Condylar Guidance Denar® Mark II

	Right			Left		
	3rd mm	5th mm	10th mm	3rd mm	5th mm	10th mm
Angle	5°	5°		5°	5°	
ISS	0.0	0.0		0.0	0.0	

s:

tor: Denar® Mark II

CADIAX® Curves

	Protrusion		Mediotrusion right		Mediotrusion left	
	SCI right	SCI left	S C I	T C I	S C I	T C I
1st	74.0°	40.7°	47.3°	8.4°	55.5°	−58.8°
2nd	71.8°	62.7°	41.1°	7.4°	50.1°	−18.3°
3rd	68.9°	56.4°	74.5°	53.0°	31.6°	9.5°
4th	66.0°	53.2°	69.0°	41.4°	30.3°	−0.4°
5th	63.1°	49.2°	63.8°	32.7°	21.4°	−8.3°
6th	60.3°	45.5°	60.9°	30.1°	49.0°	−6.1°
8th	54.9°	39.3°			42.0°	−6.0°
10th	49.1°	33.8°				
14th						
	Retrusion					
-1.		27.3°d				
-2.						

Sagittal Condylar Guidance Denar® Mark II

Right			Left		
3rd mm	5th mm	10th mm	3rd mm	5th-mm	10th mm
60°	60°	57°	60°	55°	42°

Transversal Condylar Guidance Denar® Mark II

	Right			Left		
	3rd mm	5th mm	10th mm	3rd mm	5th mm	10th mm
Angle	8°	5°	8°	8°	5°	5°
ISS	0.9	0.9	0.8	0.8	0.8	0.8

Figure (2-29) Articulator setting for TMJ patient and control

2.4 Statistical Analysis:

The following statistical data analysis approaches were used in order to analyze and assess the results of the study under application of the statistical package (SPSS) ver. (14.0):

I. Descriptive data analysis:

a. Mean value, Standard Deviation, Standard Error, (95%) Confidence interval for population Mean values, two Extreme values (min. and max.).

b. Pearson's correlation coefficient.

c. Odds Ratio of related rates : A measure of the strength of the association between the presence of a factor and the occurrence of an event.

d. Graphical presentation by using :

- Cluster Bar Charts.
- Bar Charts.

II. Inferential data analysis:

These were used to accept or reject the statistical hypotheses, which included the following:

a. Chi-Square test for testing the independency distribution of the observed frequencies and there is none restricted of an expected outcomes.

$$\chi^2 = \frac{\sum_{all\ i}(O_i - E_i)^2}{E_i}$$

Where O_i is the observed frequency of group i and E_i is the expected frequency.

b. Binomial test for testing the different of distribution of the observed frequencies of two categories nominal /or ordinal scale and there is none restricted of an expected outcomes at 50%.

The binomial probability, b(x; n, p), is calculated using:

$$b = \underset{x}{\overset{n}{C}}\, p^x q^{n-x}$$

c. Contingency Coefficient (CC) test for the cause's correlation ship of the association tables.

$$C.C. = \sqrt{\frac{\chi^2}{\chi^2 + T..}}$$

Where χ^2 is the Chi Square statistic and T.. is the overall total of the contingency table.

a- Kolmogorov - Smirnov for one sample test.

b- The One-Way ANOVA procedure produces a one-way analysis of variance for a quantitative dependent variable by a single factor (independent) variable, as well as Levene test are used for testing homogeneity of variances of different groups. Analysis of variance is used to test the hypothesis that several means are equal. In addition to that we applied after rejecting the statistical hypotheses LSD test requiring equal variances are assumed, as well as Games Howell GH test requiring equal variances are not assumed.

c- Pair wise t-test, which is equivalent to Matched paired t-test.

d- T-test for testing Pearson's correlation coefficients in two tailed alternative statistical hypothesis.

e- T-test for testing two independent groups.

f- A contingency coefficient test: A measure of association based on chi-square. The value ranges between zero and 1, with zero indicating no association between the row and column variables and values close to 1 indicating a high degree of association between the variables. The maximum value possible depends on the number of rows and columns in a table.

For the abbreviations of the comparison significant (C.S.), we used the followings:

NS : Non significant at $P>0.05$

S : Significant at $P<0.05$

HS : Highly significant at $P<0.01$

This chapter presents findings of the data analysis systematically in tables and these correspond with the objectives of this study, and as follows:

3.1 Demographical Characteristics variables:

Table (3-1) shows observed frequencies, and their percentages distribution of studied "Demographical Characteristics" variables (DCv.), age groups, and gender with comparisons significant.

Table (3-1): Distribution of the studied sample's disorders and Controlled Groups according to (Age and Gender) with comparison's significant

DCv.	Resp.	No. and %	Groups						Total diseased	C.S. P-value
			Degenerative joint disease	Arthralgia	Intraarticular	Myofascial	Headache	Control		
Age Groups Yrs.	25 -	No.	1	14	11	9	6	12	53	CC=0.510 P=0.000 HS
		%	5%	70%	55%	45%	30%	60%	44.2%	
	35 -	No.	8	5	8	10	8	8	47	
		%	40%	25%	40%	50%	40%	40%	39.2%	
	45 - 55	No.	11	1	1	1	6	0	20	
		%	55.0%	5.0%	5.0%	5.0%	30.0%	0.0%	16.7%	
Mean ± SD			44.75 ± 6.32	33.4± 6.14	34.75± 6.93	35.1± 7.48	40.5± 8.15	34.05± 4.61	37.70 ± 8.13	
Gender	Male	No.	8	8	7	10	11	10	54	CC=0.141 P=0.788 NS
		%	40%	40%	35%	50%	55%	50%	45%	
	Female	No.	12	12	13	10	9	10	66	
		%	60%	60%	65%	50%	45%	50%	55%	

(*) HS: Highly Sig. at P<0.01; NS: No Sig. at P>0.05; Testing based on Contingency Coefficient (CC).

The results indicated that highly significant different at P<0.01 are accounted for (DCv.) concerning age groups among disordered and control groups, as well as mean, and standard deviation estimates are illustrated for the studied disordered groups, and controlled which showed that degenerative joint disease group had registered elder age among others disordered groups. In addition to that, gender distribution are reported no significant difference at P>0.05.

Figure (3-1) represented "Demographical Characteristics" variables distribution of age groups, and gender at the studied groups.

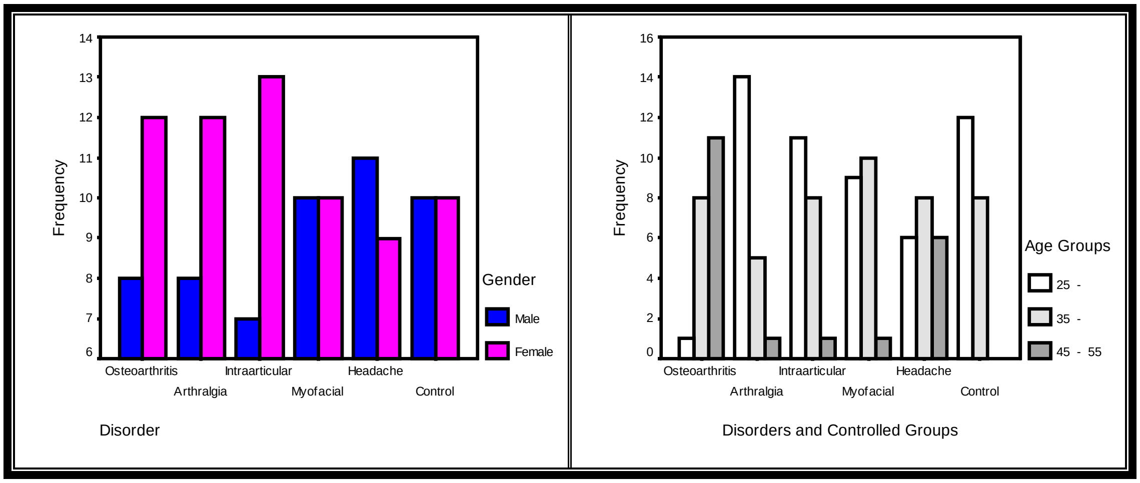


Figure (3-1): Distribution (Age and Gender) of the studied Disorders and Controlled Groups

3. 2 Diseased Group's Duration:

Table (3-2-1) shows an observed frequencies, and their percentages distribution for the studied "Diseased Group's Duration" per months with comparison significant, which showed significant different are accounted at P<0.05 among the distribution of studied of different duration's classes.

Table (3-2-1): Distribution of the studied Disorder's Groups according to (Duration) per months with comparisons significant

Var.	Resp.	No. and %	Groups					Total	C.S. P-value
			Degenerative joint disease	Arthralgia	Intraarticular	Myofascial	Headache		
Duration per months	6 - 12	No.	7	15	10	6	7	7	CC=0.396 P=0.017 S
		%	35%	75%	50%	30%	35%	35%	
	18 - 24	No.	9	5	10	10	7	9	
		%	45%	25%	50%	50%	35%	45%	
	30 - 36	No.	4	0	0	4	6	4	
		%	20%	0.0%	0.0%	20%	30%	20%	
Mean ± SD			19.80 ± 8.94	13.50 ± 6.12	16.50 ± 6.42	21.00 ± 7.41	21.60 ± 9.42	18.48 ± 8.21	

(*) **S: Sig. at P<0.05; Testing based on Contingency Coefficient (CC).**

Result has indicated a significant difference at P<0.05 concerning duration's periods distribution, as well as mean, and standard deviation estimates are illustrated for the studied disordered groups, which showed that most of disordered groups had registered a similarly durations, except Arthralgia group, and then followed by Intraarticular group, which had reported low duration periods compared with others disordered groups.

Figure (3-2-1) represent distribution of duration's periods per months in the studied disordered groups.

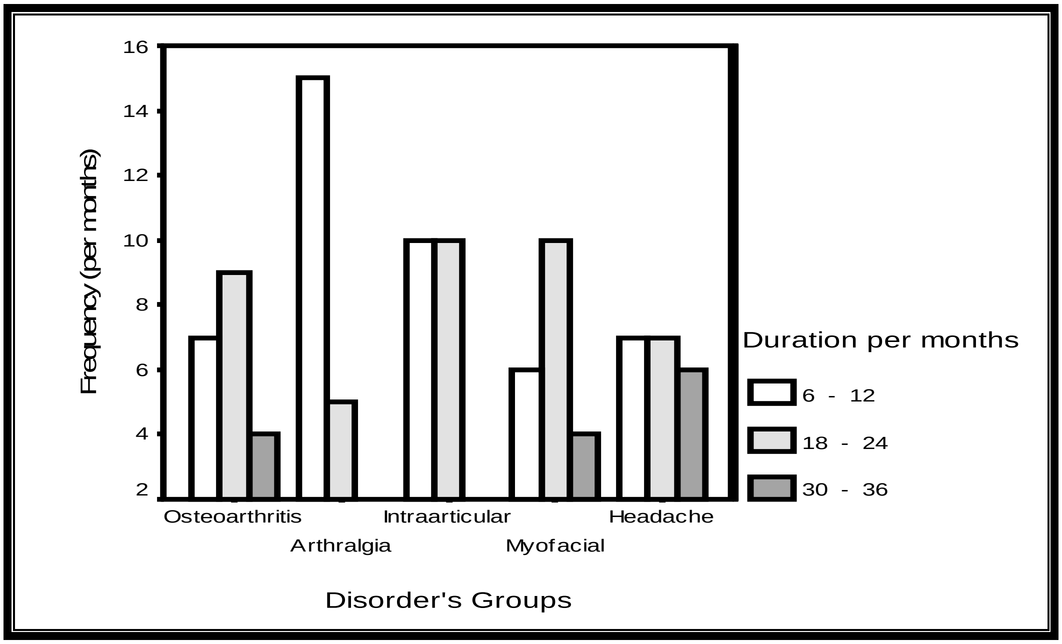


Figure (3-2-1): Distribution of Duration of the studied Disorder's Groups

Table (3-2-2) shows contingency's coefficients and their significant levels between "Duration per months", and gender in studied groups.

Table (3-2-2): Relationships of the studied sample's disorders responding according duration, and gender with comparisons significant

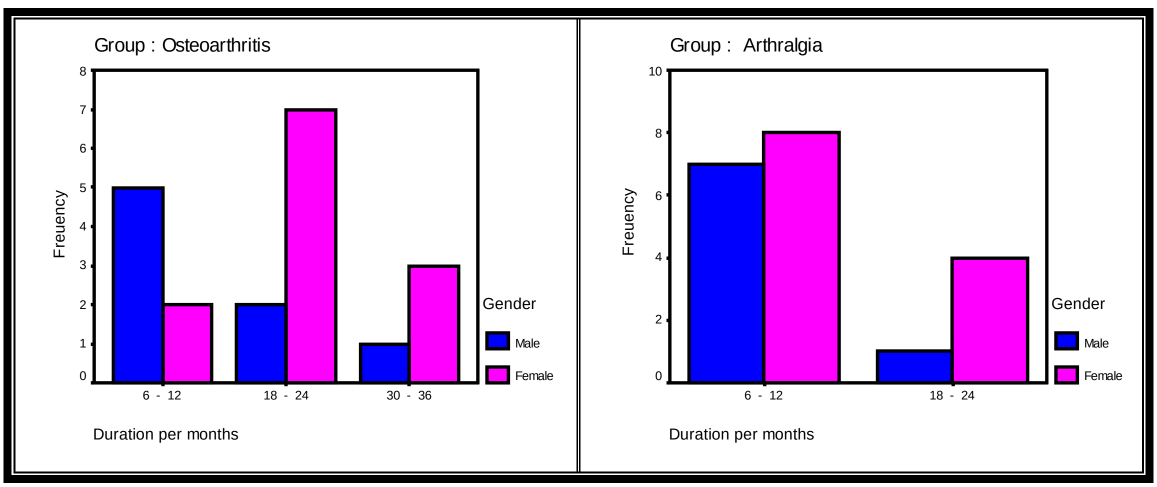
Disorders and Control Groups	Duration per months	No. and percent	Gender		Total	C.S. (*) P-value
			Male	Female		
Degenerative joint disease	6 - 12	No.	5	2	7	CC= 0.426 P=0.109 (NS)
		% Gender	62.5%	16.7%	35.0%	
	18 - 24	No.	2	7	9	
		% Gender	25.0%	58.3%	45.0%	
	30 - 36	No.	1	3	4	
		% Gender	12.5%	25.0%	20.0%	
Arthralgia	6 - 12	No.	7	8	15	CC= 0.229 P=0.292 (NS)
		% Gender	87.5%	66.7%	75.0%	
	18 - 24	No.	1	4	5	
		% Gender	12.5%	33.3%	25.0%	
	30 - 36	No.	0	0	0	
		% Gender	0.00%	0.00%	0.00%	
Intraarticular	6 - 12	No.	3	7	10	CC= 0.104
		% Gender	42.9%	53.8%	50.0%	P=0.639

	18 - 24	No.	4	6	10	(NS)
		% Gender	57.1%	46.2%	50.0%	
	30 - 36	No.	0	0	0	
		% Gender	0.00%	0.00%	0.00%	
Myofascial	6 - 12	No.	4	2	6	CC= 0.375 P=0.195 (NS)
		% Gender	40.0%	20.0%	30.0%	
	18 - 24	No.	3	7	10	
		% Gender	30.0%	70.0%	50.0%	
	30 - 36	No.	3	1	4	
		% Gender	30.0%	10.0%	20.0%	
Headache	6 - 12	No.	4	3	7	CC= 0.066 P=0.958 (NS)
		% Gender	36.4%	33.3%	35.0%	
	18 - 24	No.	4	3	7	
		% Gender	36.4%	33.3%	35.0%	
	30 - 36	No.	3	3	6	
		% Gender	27.3%	33.3%	30.0%	

(*) NS: No Sig. at P>0.05; Testing based on Contingency Coefficient test

Regarding "Duration", result showed that weak relationship had reported concerning gender distribution at P>0.05 in studied disordered groups.

Figure (3-2-2) represents cluster bar charts of (Duration) distributed between both gender in the studied of disordered groups.



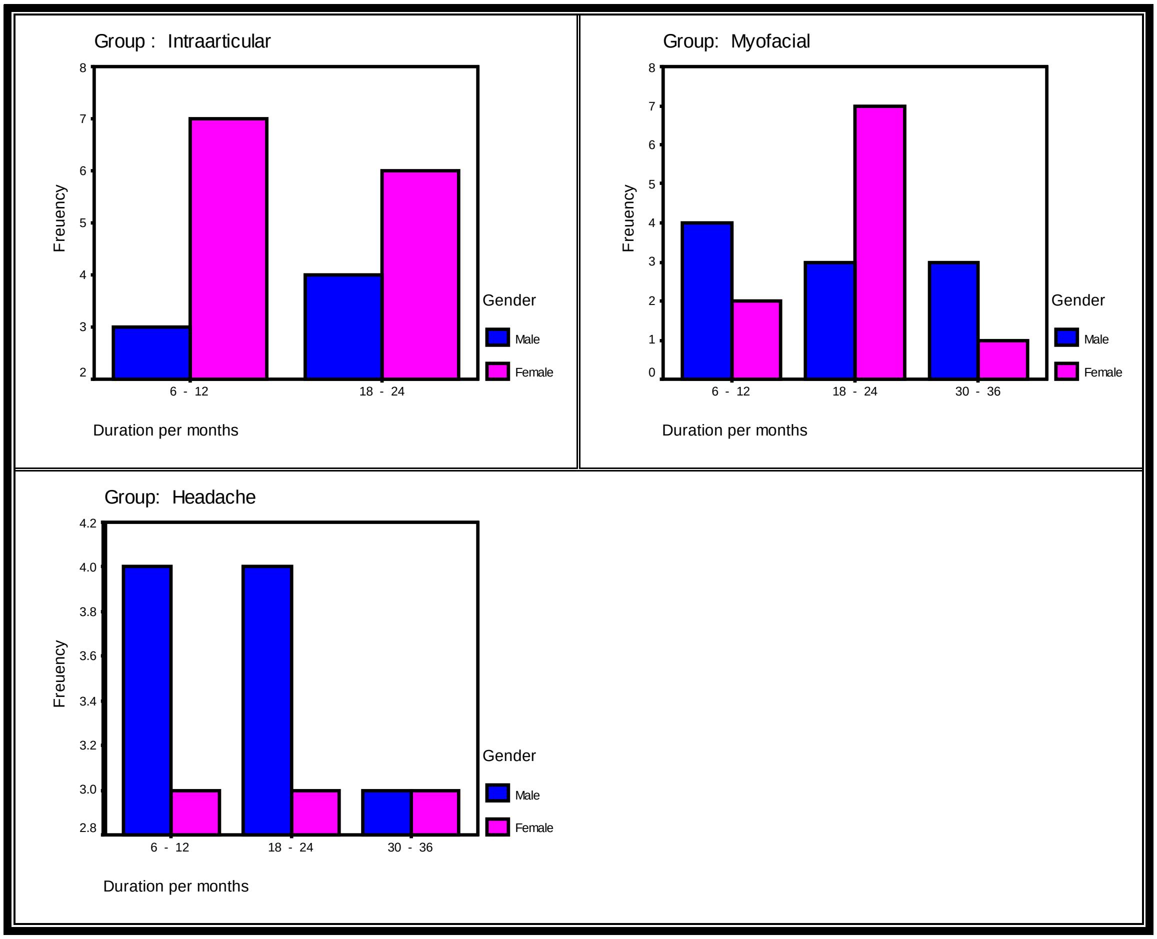


Figure (3-2-2): Distribution of the studied sample's disorders responding according to Duration (per months) and gender

3.3 Distribution of Diseased Groups Pain Parameters:

Distribution of Pain:

Table (3-3-1) shows distribution of "Pain" responding according to disordered groups (degenerative joint disease, Arthralgia, Intraarticular, Myofascial, and Headache) with comparison significant in light of the studied three categories responding (Mild, Moderate, and Sever), as well as a relationship throughout a contingency coefficient, which showed no significant different are accounted at P>0.05, rather than Myofascial, and Headache groups had recorded one quarter, and third percent at the sever level respectively.

Table (3-3-1): Distribution of the studied Disorder's Groups according to (Pain) responding with comparison significant

Var.	Resp.	No. and %	Groups					Total	C.S. P-value
			Degenerative joint disease	Arthralgia	Intraarticular	Myofascial	Headache		
Pain	Mild	No.	6	9	7	4	2	28	CC=0.327 P=0.153 NS
		%	30%	45%	35%	20%	10%	28%	
	Moderate	No.	11	10	12	11	12	56	
		%	55%	50%	60%	55%	60%	56%	
	Sever	No.	3	1	1	5	6	16	
		%	15%	5%	5%	25%	30%	16%	

(*) **NS: Non Sig. at P>0.05; Testing based on Contingency Coefficient (CC).**

Figure (3-3-1) of cluster bar chart represent of preceding distribution of contingency table.

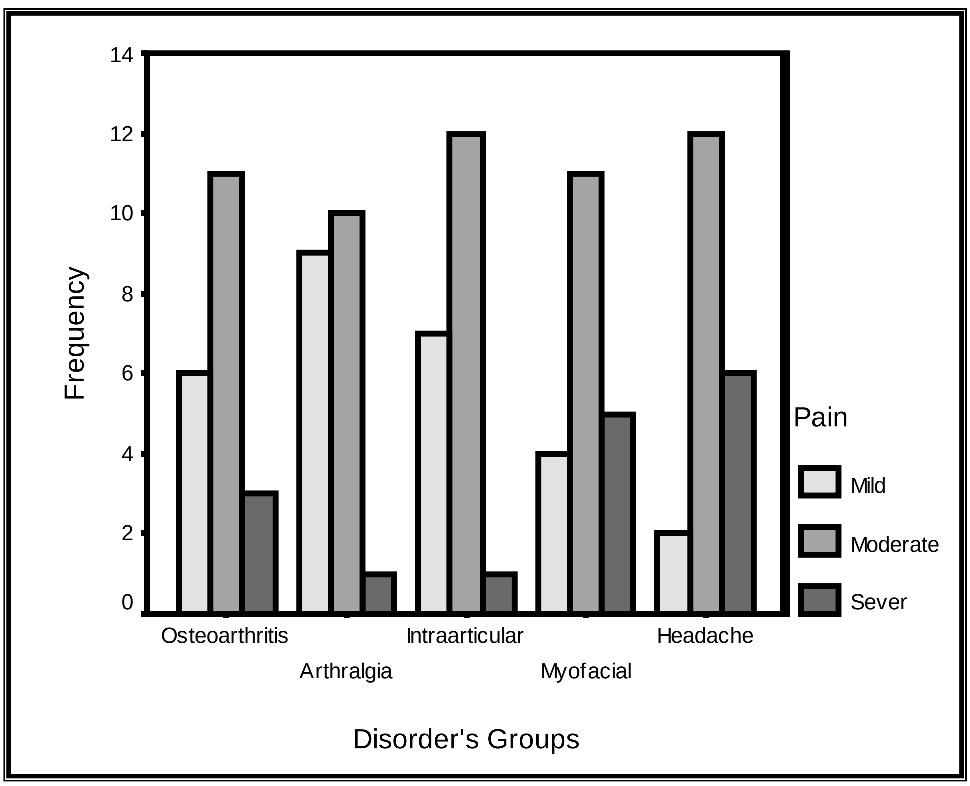


Figure (3-3-1): Cluster Bar Chart Distribution of studied Disorder's Groups according to (Pain) responding

Table (3-3-2) shows contingency's coefficients and their significant levels between "Pain" responding, and age groups in studied groups.

Table (3-3-2): Relationships of the studied sample's disorder's groups according to Age Groups and Pain responding with comparisons significant

Disorders and Control Groups	Pain Resp.	No. and percent	Age Groups 25 -	35 -	45 - 55	Total	C.S. (*) P-value
Degenerative joint disease	Mild	No.	0	3	3	6	CC= 0.326 P=0.666 (NS)
		% Age Groups	0.0%	37.5%	27.3%	30.0%	
	Moderate	No.	1	3	7	11	
		% Age Groups	100.0%	37.5%	63.6%	55.0%	
	Sever	No.	0	2	1	3	
		% Age Groups	0.0%	25.0%	9.1%	15.0%	
Arthralgia	Mild	No.	6	3	0	9	CC= 0.283 P=0.783 (NS)
		% Age Groups	42.9%	60.0%	0.0%	45.0%	
	Moderate	No.	7	2	1	10	
		% Age Groups	50.0%	40.0%	100.0%	50.0%	
	Sever	No.	1	0	0	1	
		% Age Groups	7.1%	0.0%	0.0%	5.0%	
Intraarticular	Mild	No.	3	3	1	7	CC= 0.406 P=0.414 (NS)
		% Age Groups	27.3%	37.5%	100.0%	35.0%	
	Moderate	No.	8	4	0	12	
		% Age Groups	72.7%	50.0%	0.0%	60.0%	
	Sever	No.	0	1	0	1	
		% Age Groups	0.0%	12.5%	0.0%	5.0%	
Myofascial	Mild	No.	2	2	0	4	CC= 0.365 P=0.547 (NS)
		% Age Groups	22.2%	20.0%	0.0%	20.0%	
	Moderate	No.	6	4	1	11	
		% Age Groups	66.7%	40.0%	100.0%	55.0%	
	Sever	No.	1	4	0	5	
		% Age Groups	11.1%	40.0%	0.0%	25.0%	
Headache	Mild	No.	0	0	2	2	CC= 0.459 P=0.253 (NS)
		% Age Groups	0.0%	0.0%	33.3%	10.0%	
	Moderate	No.	4	5	3	12	
		% Age Groups	66.7%	62.5%	50.0%	60.0%	
	Sever	No.	2	3	1	6	
		% Age Groups	33.3%	37.5%	16.7%	30.0%	

(*) NS: No Sig. at P>0.05; Testing based on Contingency Coefficient test

Regarding "Pain", result showed that weak relationship had reported concerning age groups distribution at P>0.05 in studied of disordered groups.

Figure (3-3-2) represents cluster bar charts of (Pain) distributed among age groups in the studied of disordered groups.

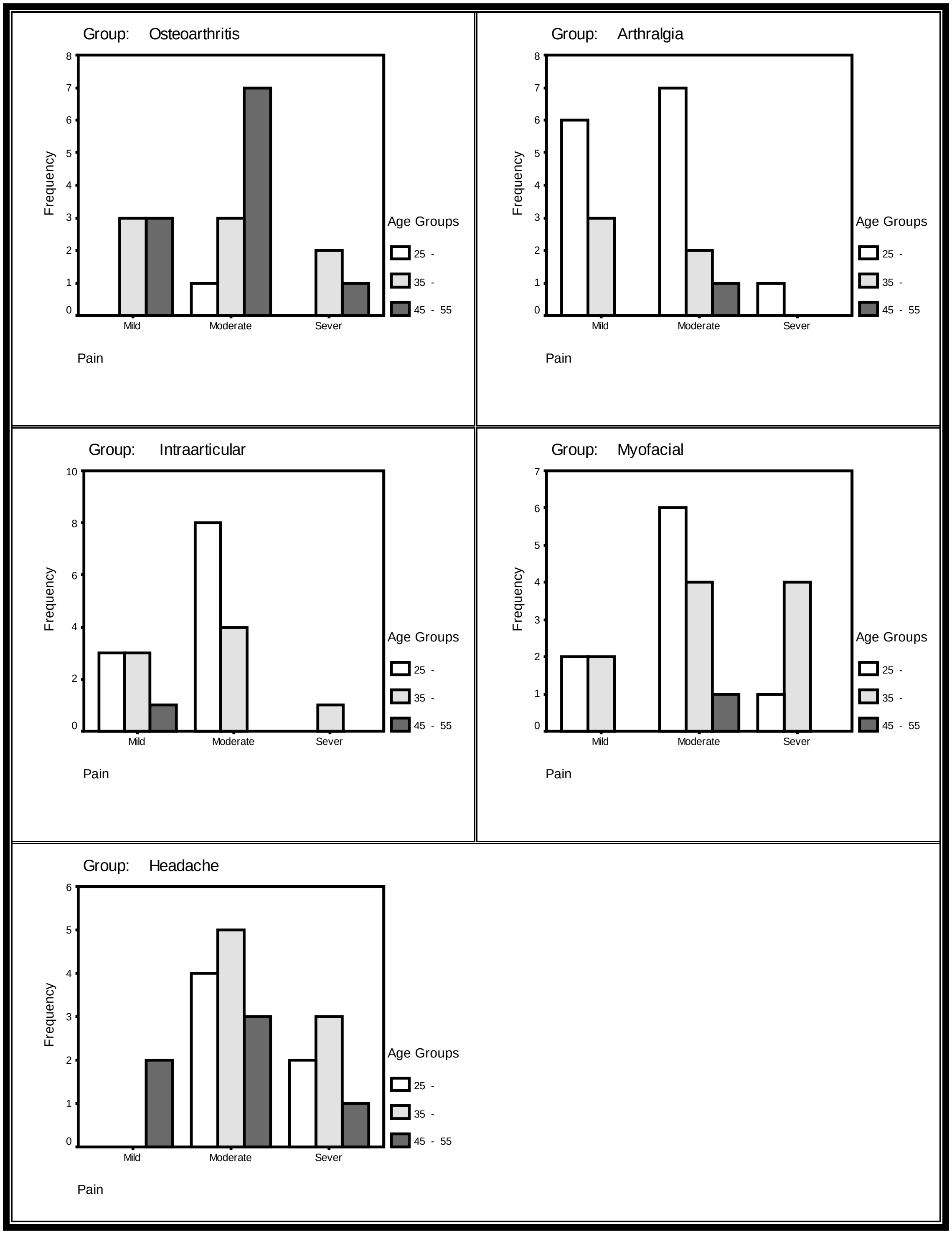


Figure (3-3-2): Distribution of the studied sample's disorder's groups according to Pain responding and Age Groups

Relationships among pain and Gender distributions:

Table (3-3-3) shows contingency's coefficients and their significant levels between "Pain" levels, and gender parameters in studied groups.

Table (3-3-3): Relationships of the studied group's disorders of pain responding according to gender with comparison's significant

Disorders and Control Groups	Pain Responses	No. and percent	Gender		Total	C.S. (*) P-value
			Male	Female		
Degenerative joint disease	Mild	No.	3	3	6	CC= 0.326 P=0.303 (NS)
		% Gender	37.5%	25.0%	30.0%	
	Moderate	No.	5	6	11	
		% Gender	62.5%	50.0%	55.0%	
	Sever	No.	0	3	3	
		% Gender	0.0%	25.0%	15.0%	
Arthralgia	Mild	No.	4	5	9	CC= 0.189 P=0.690 (NS)
		% Gender	50.0%	41.7%	45.0%	
	Moderate	No.	4	6	10	
		% Gender	50.0%	50.0%	50.0%	
	Sever	No.	0	1	1	
		% Gender	0.0%	8.3%	5.0%	
Intraarticular	Mild	No.	3	4	7	CC= 0.189 P=0.690 (NS)
		% Gender	42.9%	30.8%	35.0%	
	Moderate	No.	4	8	12	
		% Gender	57.1%	61.5%	60.0%	
	Sever	No.	0	1	1	
		% Gender	0.0%	7.7%	5.0%	
Myofacial	Mild	No.	4	0	4	CC= 0.477 P=0.053 (NS)
		% Gender	40.0%	0.0%	20.0%	
	Moderate	No.	5	6	11	
		% Gender	50%	60%	55%	
	Sever	No.	1	4	5	
		% Gender	10%	40%	25%	
Headache	Mild	No.	2	0	2	CC= 0.352 P=0.243 (NS)
		% Gender	18.2%	0.0%	10.0%	
	Moderate	No.	7	5	12	
		% Gender	63.6%	55.6%	60.0%	
	Sever	No.	2	4	6	
		% Gender	18.2%	44.4%	30.0%	

(*) NS: No Sig. at P>0.05; Testing based on Contingency Coefficient test

Regarding "Pain" parameter, result showed that weak relationship had reported concerning gender distribution at P>0.05 along studied disordered groups.

In addition to that, female are illustrated a sever responding more than male along all of the studied groups.

Figure (3-3-3) represents cluster bar charts of (Pain) parameter distributed between both gender in the studied of disordered groups.

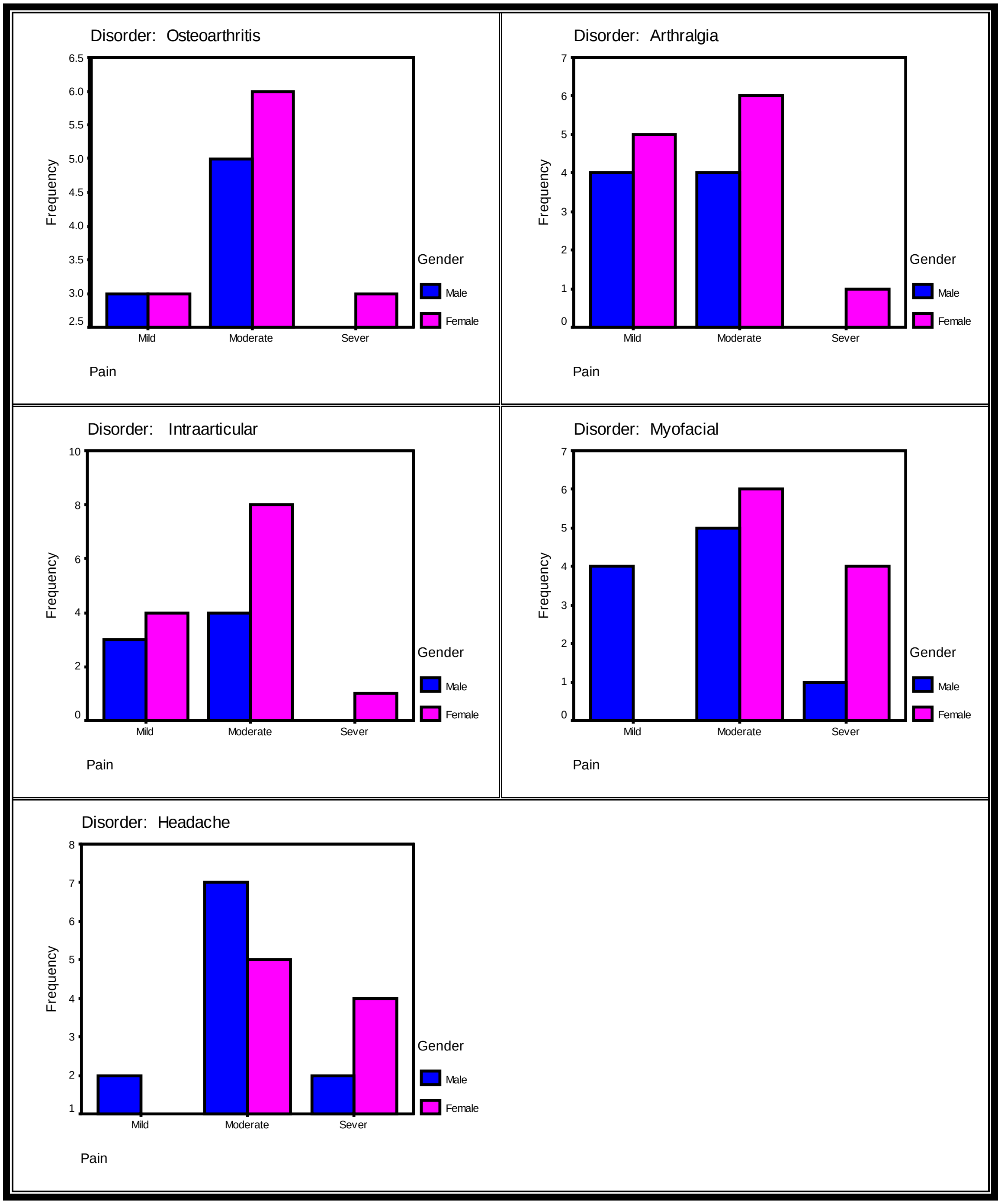


Figure (3-3-3): Distribution of the studied disorder's responding of pain responding according to gender

3.4 Distribution of Opening Pattern:

Table (3-4-1) shows distribution of "Opening Pattern" responding according to disordered groups (degenerative joint disease, Arthralgia, Intraarticular, Myofascial, and Headache), as well as controlled group with comparison significant in light of two categories responding (Correct, and Straight), as well as a relationship throughout a contingency coefficient, which showed a significant relationship accounted at P<0.05, in which Degenerative joint disease group had the vast majority responding within correct level.

Table (3-4-1): Distribution of the studied Groups according to (Opening pattern) factor with comparisons significant

Var.	Resp.	No. and %	Groups					Total	C.S. P-value
			Degenerative joint disease	Arthralgia	Intraarticular	Myofascial	Headache		
Opening pattern	Correct	No.	16	11	6	9	10	52	CC=0.310 P=0.031 S
		%	80%	55%	30%	45%	50%	43%	
	Straight	No.	4	9	14	11	10	68	
		%	20%	45%	70%	55%	50%	57%	

(*) S: Sig. at P<0.05; Testing based on Contingency Coefficient (CC).

Excluded control group reported P=0.031 with CC=0.310

Figure (3-4-1) of cluster bar chart represent of preceding distribution of contingency table.

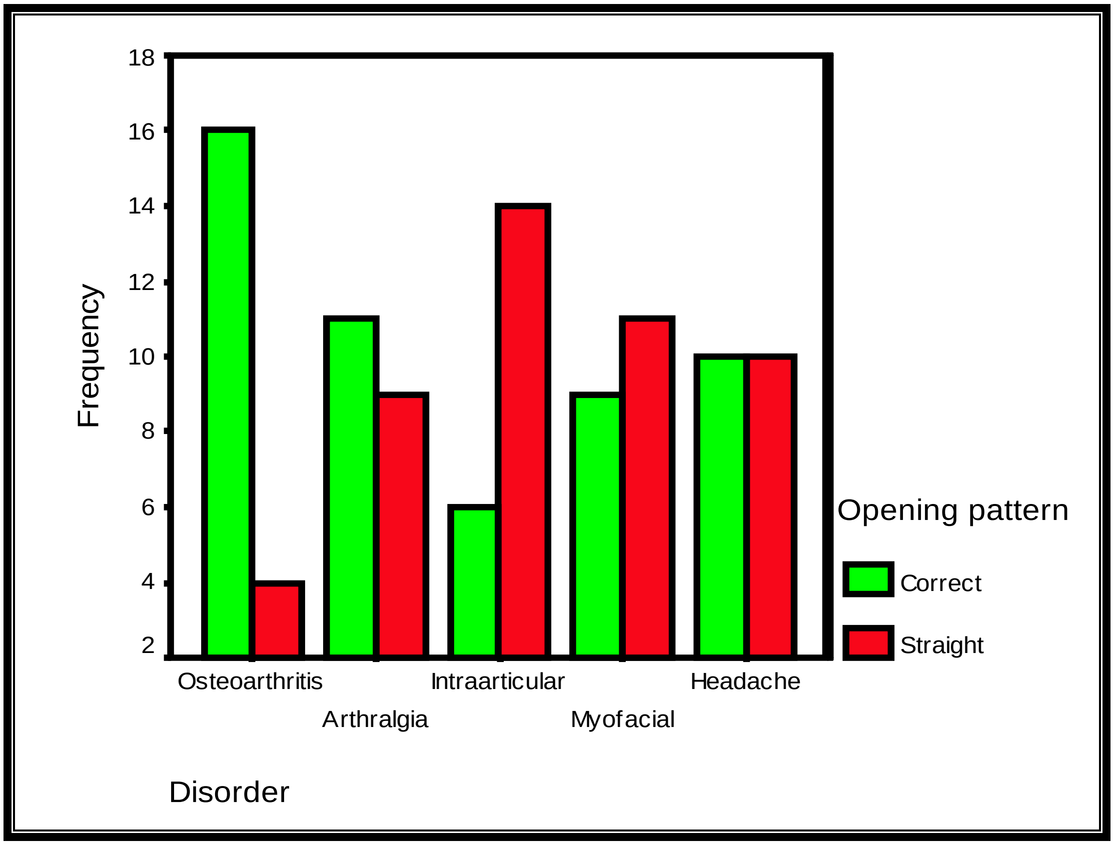


Figure (3-4-1): Distribution of Opening pattern for the studied sample's Disorders

Table (3-4-2) shows contingency's coefficients and their significant levels between "Opening Pattern" responding, and age groups in studied groups.

Table (3-4-2): Relationships of the studied sample's disorder's groups according to Age Groups and Opening Pattern Status with comparisons significant

Disorders and Control Groups	Opening Pattern	No. and percent	Age Groups 25 -	35 -	45 - 55	Total	C.S. (*) P-value
Degenerative joint disease	Correct	No.	1	6	9	16	CC= 0.140 P=0.820 (NS)
		% Age Groups	100%	75.0 %	81.8 %	80.0 %	
	Straight	No.	0	2	2	4	
		% Age Groups	0.0%	25.0 %	18.2 %	20.0 %	
Arthralgia	Correct	No.	8	3	0	11	CC= 0.247 P=0.522 (NS)
		% Age Groups	57.1 %	60.0 %	0.0%	55.0 %	
	Straight	No.	6	2	1	9	
		% Age Groups	42.9 %	40.0 %	100%	45.0 %	

Intraarticular	**Correct**	**No.**	**3**	**3**	**0**	**6**	**CC= 0.182 P=0.711 (NS)**
		% Age Groups	**27.3 %**	**37.5 %**	**0.0%**	**30.0 %**	
	Straight	**No.**	**8**	**5**	**1**	**14**	
		% Age Groups	**72.7 %**	**62.5 %**	**100%**	**70.0 %**	
Myofascial	**Correct**	**No.**	**3**	**5**	**1**	**9**	**CC= 0.289 P=0.403 (NS)**
		% Age Groups	**33.3 %**	**50.0 %**	**100%**	**45.0 %**	
	Straight	**No.**	**6**	**5**	**0**	**11**	
		% Age Groups	**66.7 %**	**50.0 %**	**0.0%**	**55.0 %**	
Headache	**Correct**	**No.**	**3**	**4**	**3**	**10**	**CC= 0.000 P=1.000 (NS)**
		% Age Groups	**50%**	**50%**	**50%**	**50%**	
	Straight	**No.**	**3**	**4**	**3**	**10**	
		% Age Groups	**50%**	**50%**	**50%**	**50%**	

(*) **NS: No Sig. at P>0.05; Testing based on Contingency Coefficient test**

Regarding "Opening Pattern" responding, result showed that weak relationship had reported concerning age groups distribution at P>0.05 in studied of disordered groups.

Figure (3-4-2) represents cluster bar charts of (Opening Pattern) distributed among age groups in the studied of disordered groups.

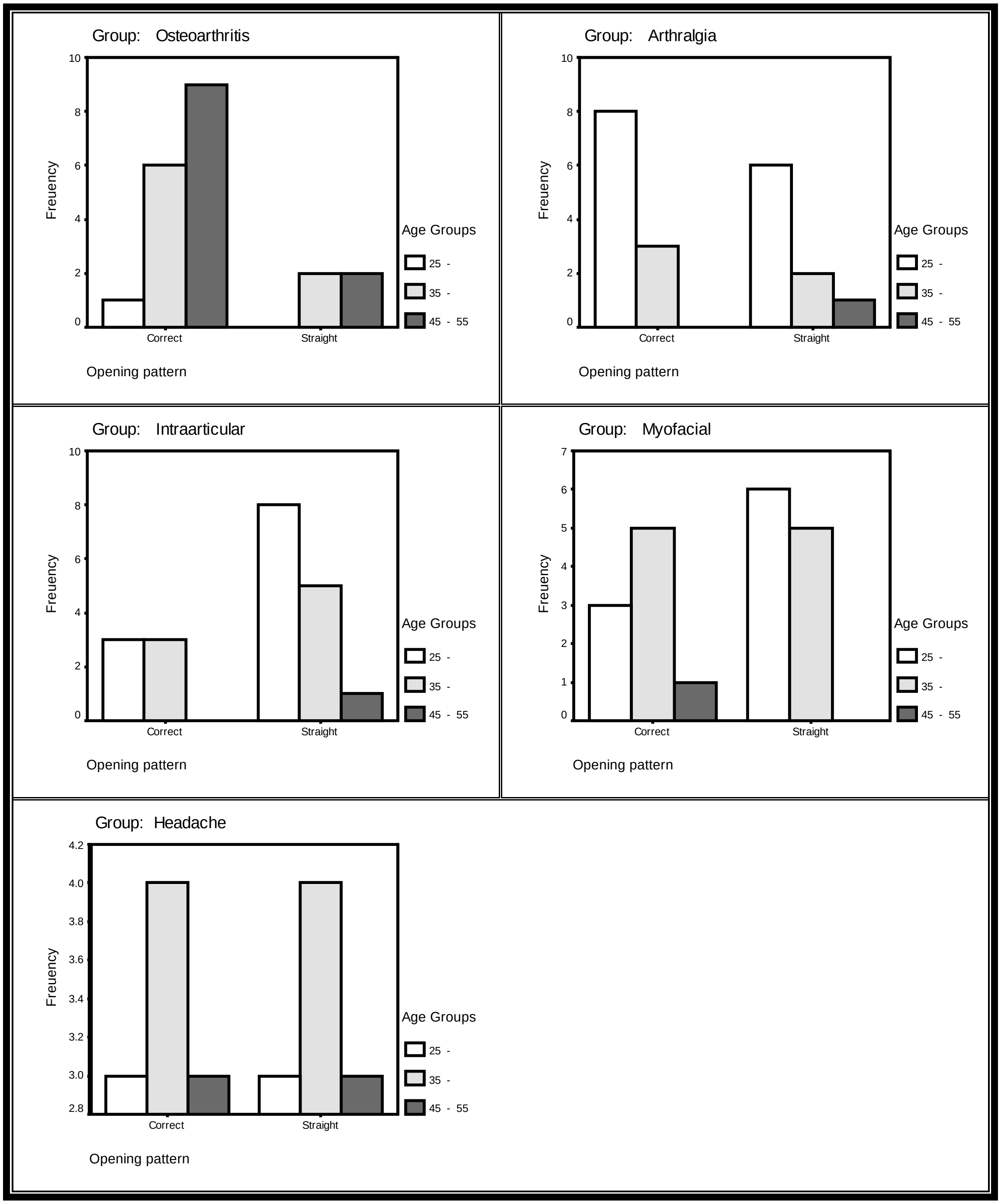


Figure (3-4-3): Distribution of the studied disorder's groups according to Opening Pattern Status and Age Groups

3.5 Muscles of mastication involved

Distribution of Muscle involved:

Table (3-5-1) shows distribution of "Muscle involved" responding according to (Myofascial, and Headache) disorders groups, with comparison significant in light of three categories responding (Muscle involved (Masseter), Muscle involved (Temporalis), and Muscle involved (Masseter +Temporalis), as well as a relationship throughout a contingency coefficient, which showed a highly significant relationship accounted at P<0.01, in which Myofascial group had the vast majority responding within Muscle involved of (Masseter) level, while Headache group had mostly recorded within Muscle involved of (Temporalis) level, as well as one fifth percent are reported within mixed level (M+T).

Table (3-5-1): Distribution of the studied Groups according to (Muscle involved) factor with comparisons significant

Var..	Responding	No. and %	Groups		Total	C.S. P-value
			Myofascial	Headache		
Muscle involved	Muscle involved (M)	No.	16	0	16	CC=0.636 P=0.000 HS
		%	80%	0.0%	40%	
	Muscle involved (T)	No.	4	16	20	
		%	20%	80%	50%	
	Muscle involved (M+T)	No.	0	4	4	
		%	0.0%	20%	10%	

(*) HS: Highly Sig. at P<0.01; Testing based on Contingency Coefficient (CC).

Figure (3-5-1) of cluster bar chart represent of preceding distribution of contingency table.

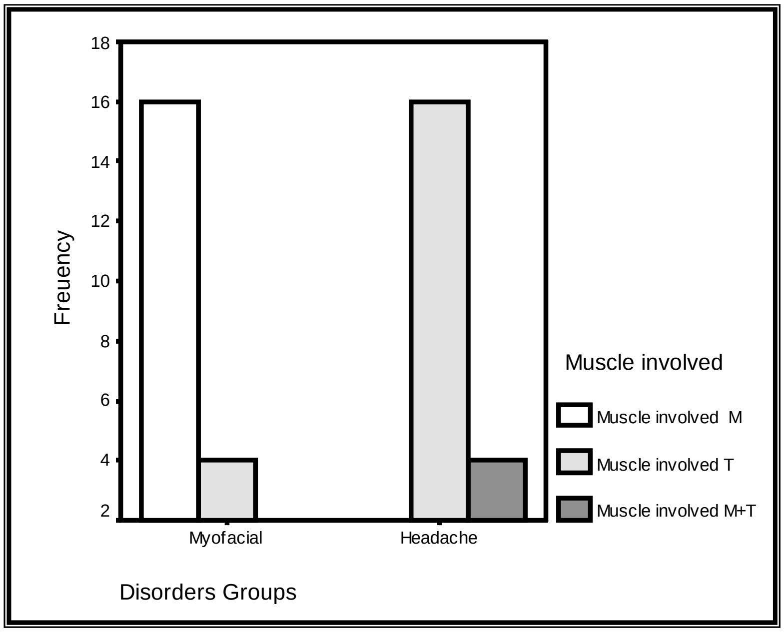


Figure (3-5-1): Distribution of Opening pattern for the studied sample's Disorders and Control Groups

Distribution of areas involved in myofascial disorder

Table (3-5-2) showed Distribution of the studied sample's disorder Myofascial according to (Area Involved) of both masseter and temporalis muscles as well as a relationship throughout a contingency coefficient, in which Masseter muscle had the vast majority responding within middle and superior areas and Temporalis responding within middle anterior area.

Table (3-5-2): Distribution of the studied sample's disorder (Myofascial) according to (Area Involved) with comparison's significant

Disorder site	No. & %	Area Involved							Total
		Middle + Anterior Temporalis	Middle Temporalis	Middle + Posterior Temporalis	Middle masseter	Middle + Superior Masseter	Middle + Inferior Masseter	Superior Masseter	
Myofascial	No.	2	1	1	5	8	2	1	20
	%	10%	5%	5%	25%	40%	10%	5%	100%
C.S. (*) P-value		K.S.=0.417 HS							

(*) HS: Highly Sig. at P<0.01; Testing based on Kolmogorov- Smirnov test

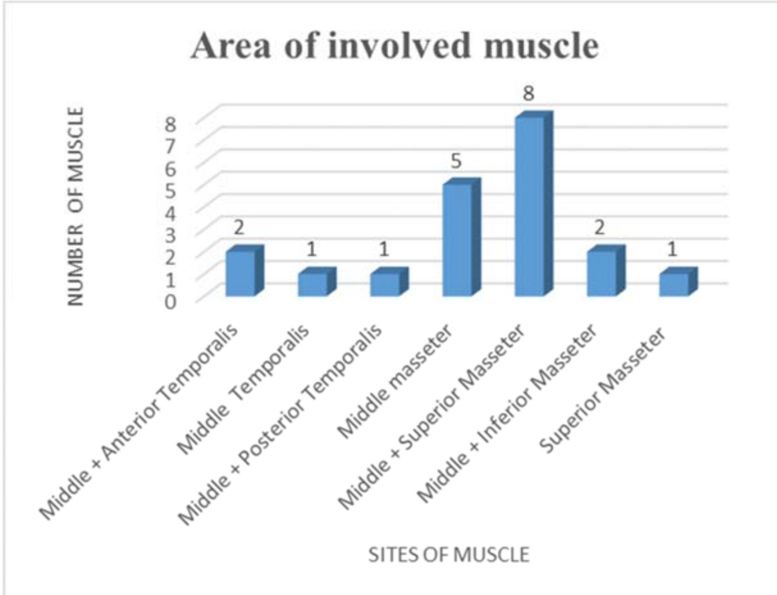


Figure (3-5-2): Distribution Areas Involved for the studied sample's Myofascial muscles

Distribution of supplemental muscle in myofascial disorder

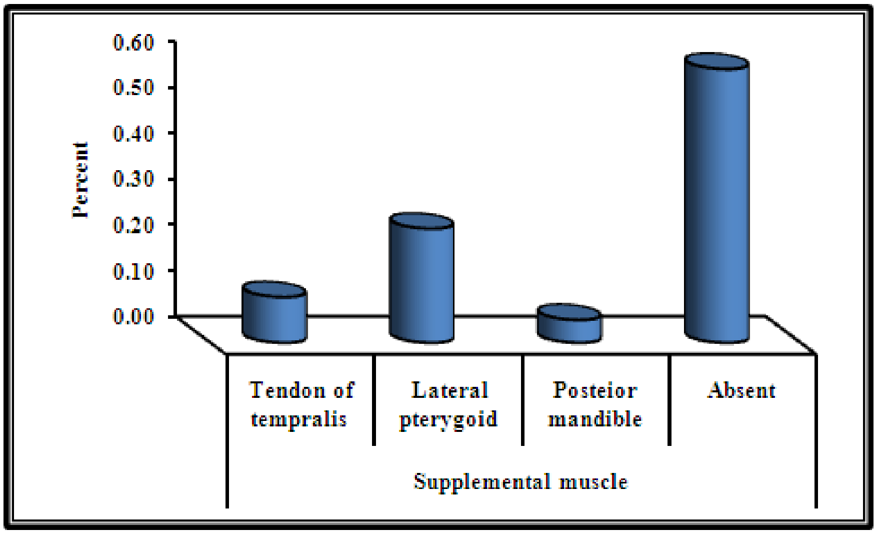
Table (3-5-3) shows presence of "Supplemental muscles" responding according to Myofascial disorders group, with comparison significant

Table (3-5-3): Distribution of the studied sample's disorder (Myofascial) according to (Supplemental muscle) with comparison's significant

Disorder	No. & %	Supplemental muscle				Total
		Tendon of temporalis	Lateral pterygoid	Posterior mandible	Absent	
Myofascial	No.	2	5	1	12	20
	%	10.0%	25.0%	5.0%	60.0%	100%
C.S. P-value		K.S.=0.250 NS				

(*) NS: Non Sig. at P>0.05; Testing based on Kolmogorov- Smirnov test

Figure (3-5-3): Distribution Supplemental muscle for the studied sample's Myofascial Disorder



3.6 Distribution of mouth openings Parameters:

Table (3-6-1) shows a summary statistics of (Maximum Mouth Opening, and Assisted Mouth Opening) in the studied groups, such that, mean values, standard deviation, standard error, 95% confidence interval for the population mean, and the two extreme values (minimum, and maximum).

Table (3-6-1): Summary Statistics of Maximum Mouth Opening and Assisted Mouth Opening Parameters for studied sample's disorders and control groups

Parameter	Disorders and Control Groups	No.	Mean	S.D.	S.E.	95% C.I. for Mean		Min.	Max.
						L.B.	U.B.		
Maximum Mouth Opening	Degenerative joint disease	20	41.55	5.75	1.29	38.86	44.24	27	50
	Arthralgia	20	44.40	4.35	0.97	42.37	46.43	35	50
	Intraarticular	20	45.25	4.69	1.05	43.06	47.44	37	56
	Myofascial	20	42.05	3.71	0.83	40.32	43.78	37	50
	Headache	20	44.00	4.28	0.96	42.00	46.00	36	52
	Control	20	48.80	4.19	0.94	46.84	50.76	42	55
Assisted Mouth Opening	Degenerative joint disease	20	44.45	5.90	1.32	41.69	47.21	29	52
	Arthralgia	20	47.00	4.79	1.07	44.76	49.24	37	53
	Intraarticular	20	47.50	4.76	1.06	45.27	49.73	41	60
	Myofascial	20	44.40	3.75	0.84	42.65	46.15	39	53
	Headache	20	46.40	4.20	0.94	44.44	48.36	39	55
	Control	20	51.70	4.78	1.07	49.46	53.94	43	58

Regarding to "Maximum Mouth Opening", degenerative joint disease, and Myofascial groups had recorded too low mean value, then followed by Headache, and Arthralgia, groups, while high levels are recorded by Intraarticular group, even though vast majority are recorded within controlled group.

On the subject "Assisted Mouth Opening", Degenerative joint disease, and Myofascial groups had recorded too low mean value, then followed by Headache group, while high levels are recorded by Intraarticular, and Arthralgia groups, even with vast majority are recorded within controlled group.

Figure (3-6-1) represents graphically plotting bar charts of the mean values of (Maximum Mouth Opening, and Assisted Mouth Opening) parameters in the studied groups.

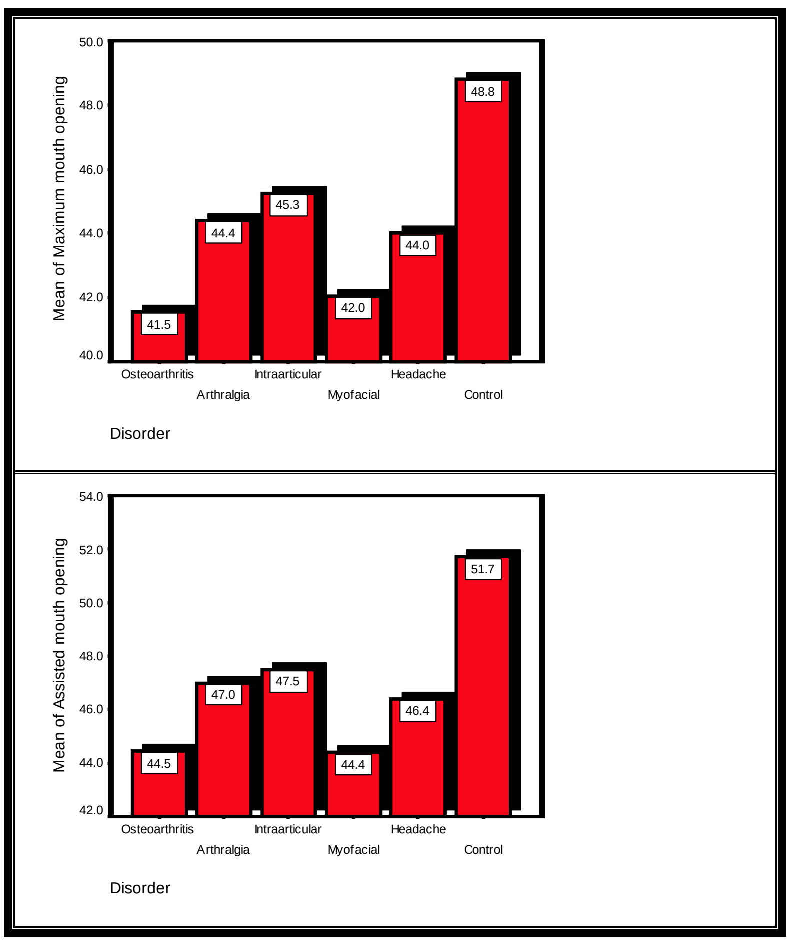


Figure (3-6-1): Distribution of Maximum Mouth Opening, and Assisted Mouth Opening Parameters for studied sample's disorders and control groups

With respect to test statistical hypotheses, which says that group's readings concerning (Maximum Mouth Opening, and Assisted Mouth Opening) parameters are thrown from the same population, and that should be proved according to equality of variances and equality of means by applying "Levene and one-way ANOVA respectively, and as illustrated in table (3-6-1-1).

Table (3-6-1-1): Testing Maximum Mouth Opening, and Assisted Mouth Opening Parameters according to equality of variances and equality of means

Mouth Opening	Testing Homogeneity of Variances		ANOVA- Testing equality of means	
	Levene Statistic	Sig. (*)	F	Sig. (*)
Maximum	0.204	0.960 NS	6.578	0.000 HS
Assisted	0.461	0.804 NS	6.387	0.000 HS

(*) HS: Highly Significant at P< 0.01; NS: No Sig. at P>0.05

A highly significant different at P<0.01 had been registered in testing equality of means, while no significant differences for testing of equality of variances. The obvious results needs to be continuing the test through applying least significant difference (LSD) test as it's shown in table (4-5-1-2), since LSD method assuming that variances between the studied groups are equal.

Multiple comparisons through applying LSD method are illustrated the statistical differences for "Maximum Mouth Opening, and Assisted Mouth Opening" parameters between all probable contrast's groups, and as follows:

Table (3-6-1-2): Comparisons significant by (LSD) of Mouth Opening (Maximum, and Assisted) among studied groups

Mouth Opening	Group (I)	Group (J)	Mean Diff. (I-J)	Sig. (*)	LSD
Maximum	Degenerative joint disease	Arthralgia	-2.850	0.049	2.84
		Intraarticular	-3.700	0.011	2.84
		Myofascial	-0.500	0.728	2.84
		Headache	-2.450	0.090	2.84
		Control	-7.250	0.000	2.84
	Arthralgia	Intraarticular	-0.850	0.555	2.84
		Myofacial	2.350	0.104	2.84
		Headache	0.400	0.781	2.84

		Control	**-4.400**	**0.003**	**2.84**
	Intraarticular	**Myofascial**	**3.200**	**0.028**	**2.84**
		Headache	**1.250**	**0.386**	**2.84**
		Control	**-3.550**	**0.015**	**2.84**
	Myofascial	**Headache**	**-1.950**	**0.177**	**2.84**
		Control	**-6.750**	**0.000**	**2.84**
	Headache	**Control**	**-4.800**	**0.001**	**2.84**
Assisted	**Degenerative joint disease**	**Arthralgia**	**-2.550**	**0.092**	**2.97**
		Intraarticular	**-3.050**	**0.044**	**2.97**
		Myofascial	**0.050**	**0.973**	**2.97**
		Headache	**-1.950**	**0.196**	**2.97**
		Control	**-7.250**	**0.000**	**2.97**
	Arthralgia	**Intraarticular**	**-0.500**	**0.739**	**2.97**
		Myofascial	**2.600**	**0.086**	**2.97**
		Headache	**0.600**	**0.690**	**2.97**
		Control	**-4.700**	**0.002**	**2.97**
	Intraarticular	**Myofascial**	**3.100**	**0.041**	**2.97**
		Headache	**1.100**	**0.465**	**2.97**
		Control	**-4.200**	**0.006**	**2.97**
	Myofascial	**Headache**	**-2.000**	**0.185**	**2.97**
		Control	**-7.300**	**0.000**	**2.97**
	Headache	**Control**	**-5.300**	**0.001**	**2.97**

(*) HS: Highly Sig. at P<0.01; S: Sig. at P<0.05; NS: No Sig. at P>0.05; Testing based on Least Significant Difference (LSD) test

Results shows mean differences, significant levels, and least significant differences for studied parameters "Maximum Mouth Opening, and Assisted Mouth Opening".

3.7 Distribution of excursive movement Parameters:

Table (3-7-1) shows a summary statistics of (Mediotrusion-Right, and Mediotrusion-Left) in the studied groups, such that, mean values, standard deviation, standard error, 95% confidence interval for the population mean, and the two extreme values (minimum, and maximum).

Table (3-7-1): Summary Statistics of Mediotrusion site's Parameter for studied sample's disorder and control group

Mediotrusion	Disorders and Control Groups	No.	Mean	S.D.	S.E.	95% C.I. for Mean		Min.	Max.
						L.B.	U.B.		
Right	Degenerative joint disease	20	7.20	1.15	0.26	6.66	7.74	4	9
	Arthralgia	20	8.25	0.79	0.18	7.88	8.62	7	10
	Intraarticular	20	8.20	0.89	0.20	7.78	8.62	7	10
	Myofascial	20	6.60	0.88	0.20	6.19	7.01	5	8
	Headache	20	7.55	1.19	0.27	6.99	8.11	5	9
	Control	20	9.50	1.00	0.22	9.03	9.97	8	11
Left	Degenerative joint disease	20	7.40	1.35	0.30	6.77	8.03	4	9
	Arthralgia	20	7.60	1.43	0.32	6.93	8.27	5	11
	Intraarticular	20	8.15	1.09	0.24	7.64	8.66	7	11
	Myofascial	20	6.65	1.14	0.25	6.12	7.18	5	9
	Headache	20	7.40	1.10	0.24	6.89	7.91	6	9
	Control	20	9.25	1.02	0.23	8.77	9.73	7	11

Regarding to Mediotrusion-Right, Myofascial group had recorded too low mean value, then followed by Degenerative joint disease, and Headache groups, while high levels recorded by Arthralgia, and Intraarticular, even though vast majority were recorded within controlled group.

On the subject Mediotrusion-Left, Myofascial group had recorded too low mean value, then followed by Degenerative joint disease, Headache, and Arthralgia groups, while high levels were recorded by Intraarticular, even with vast majority were recorded within controlled group.

Figure (3-7-1) represents graphically plotting bar charts of the mean values of (Mediotrusion-Right, and Mediotrusion-Left) parameters for the studied groups.

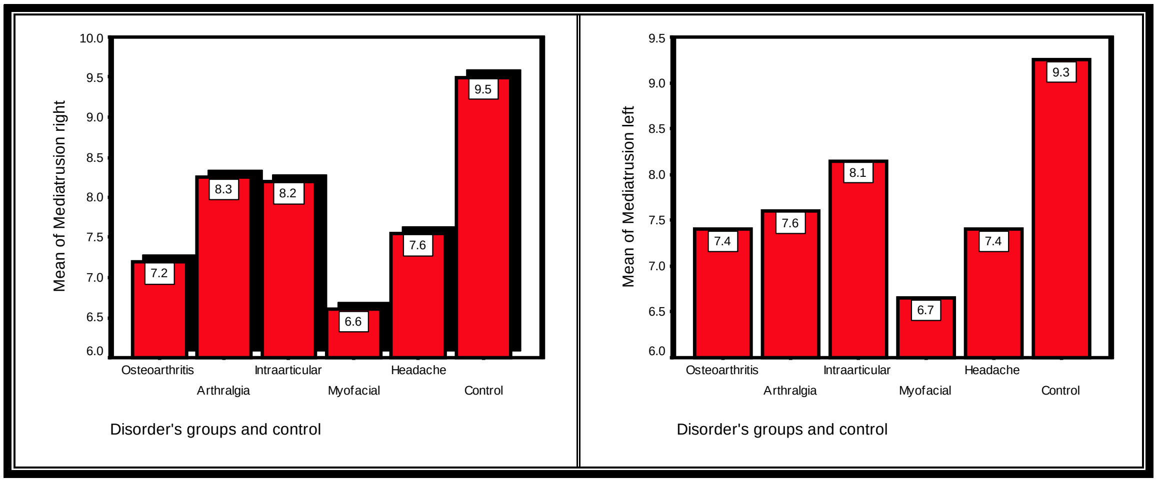


Figure (3-7-1): Bar Charts of the mean values of (Mediotrusion-Right, and Mediotrusion-Left) parameters for the studied groups

With respect to test statistical hypotheses, which says that group's readings concerning (Mediotrusion-Right, and Mediotrusion-Left) parameters are thrown from the same population, and that should be proved according to equality of variances and equality of means by applying "Levene and one-way ANOVA respectively, and as illustrated in table (3-6-1-1).

Table (3-7-1-1): Testing Mediotrusion parameter (Right, and Left) according to equality of variances and equality of means

Mediotrusion	Testing Homogeneity of Variances		ANOVA- Testing equality of means	
	Levene Statistic	Sig. (*)	F-test	Sig. (*)
Right	1.061	0.386 NS	20.491	0.000 HS
Left	0.743	0.593 NS	10.858	0.000 HS

(*) HS : Highly Significant at P< 0.01

A highly significant different at P<0.01 had been registered in testing equality of means, as well as no significant differences for testing of equality of variances either for right or left Mediotrusion. The obvious results needs to be continuing the test through applying least significant difference (LSD) test as it's shown in table (3-7-1-2), since LSD method assuming that variances between the studied groups are equal.

Multiple comparisons through applying LSD method are illustrated the statistical differences for Mediotrusion parameter between all probable contrast's groups, and as follows:

Table (3-7-1-2): Pair wise Comparisons by (LSD) test of Mediotrusion (Right, and Left) sites among studied sample's disorder and control group

Group (I)	Group (J)	Right Mean Diff. (I-J)	Right Sig. (*)	Right LSD	Left Mean Diff. (I-J)	Left Sig. (*)	Left LSD
Degenerative joint disease	Arthralgia	-1.050	0.001	0.62	-0.200	0.598	0.75
	Intraarticular	-1.000	0.002	0.62	-0.750	0.050	0.75
	Myofascial	0.600	0.059	0.62	0.750	0.050	0.75
	Headache	-0.350	0.268	0.62	0.000	1.000	0.75
	Control	-2.300	0.000	0.62	-1.850	0.000	0.75
Arthralgia	Intraarticular	0.050	0.874	0.62	-0.550	0.149	0.75
	Myofascial	1.650	0.000	0.62	0.950	0.013	0.75
	Headache	0.700	0.028	0.62	0.200	0.598	0.75
	Control	-1.250	0.000	0.62	-1.650	0.000	0.75
Intraarticular	Myofascial	1.600	0.000	0.62	1.500	0.000	0.75
	Headache	0.650	0.041	0.62	0.750	0.050	0.75
	Control	-1.300	0.000	0.62	-1.100	0.004	0.75
Myofascial	Headache	-0.950	0.003	0.62	-0.750	0.050	0.75
	Control	-2.900	0.000	0.62	-2.600	0.000	0.75
Headache	Control	-1.950	0.000	0.62	-1.850	0.000	0.75

(*) HS: Highly Sig. at P<0.01; S: Sig. at P<0.05; NS: No Sig. at P>0.05; Testing based on Least Significant Difference (LSD) test

Results shows mean differences, significant levels, and least significant differences either for right, or for left Mediotrusion parameter.

Distribution protrusion Parameters:

Table (3-7-2) shows a summary statistics of (Protrusion) in the studied groups, such that, mean values, standard deviation, standard error, 95% confidence interval for the population mean, and the two extreme values (minimum, and maximum).

Table (3-7-2): Summary Statistics of Protrusion Parameter for studied sample's disorder and control groups

Parameter	Disorders and Control Groups	No.	Mean	S.D.	S.E.	95% C.I. for Mean		Min.	Max.
						L.B.	U.B.		
Protrusion	Degenerative joint disease	20	5.30	1.30	0.29	4.69	5.91	3	8
	Arthralgia	20	5.95	1.00	0.22	5.48	6.42	5	8
	Intraarticular	20	5.45	0.89	0.20	5.03	5.87	4	7
	Myofascial	20	4.95	0.94	0.21	4.51	5.39	4	7
	Headache	20	5.70	0.92	0.21	5.27	6.13	4	8
	Control	20	7.85	0.75	0.17	7.50	8.20	6	9

Regarding to "Protrusion", Myofascial group had recorded too low mean value, then followed by Osteoarthritis, and Intraarticular groups, followed by Arthralgia, and Headache, even though vast majority are recorded within controlled group.

Figure (3-7-2) represents graphically plotting bar chart of the mean values of (Protrusion) parameter for the studied groups.

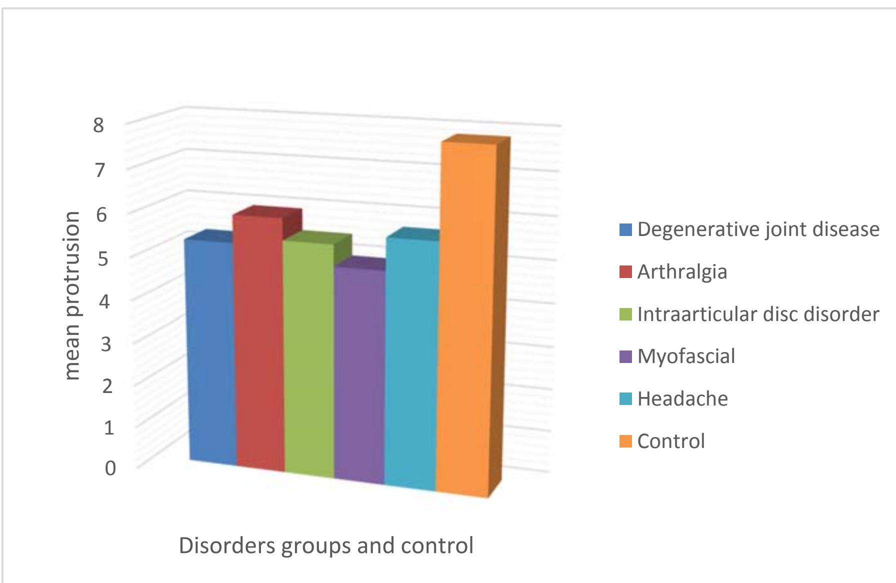


Figure (3-7-2): Distribution of Protrusion Parameter for studied sample's disorders and control groups

With respect to test statistical hypotheses, which says that group's readings concerning (Protrusion) parameter are thrown from the same population, and that should be proved according to equality of variances and equality of means by applying "Levene and one-way ANOVA respectively, and as illustrated in table (3-7-2-1).

Table (3-7-2-1): Testing Protrusion parameter according to equality of variances and equality of means

Parameter	Testing Homogeneity of Variances		ANOVA- Testing equality of means	
	Levene Statistic	Sig. (*)	F	Sig. (*)
Protrusion	1.511	0.192 NS	9.012	0.000 HS

(*) HS : Highly Significant at P< 0.01; NS: No Sig. at P>0.05

A highly significant different at P<0.01 had been registered in testing equality of means, as well as no significant differences for testing of equality of variances. The obvious results needs to be continuing the test through applying least significant difference (LSD) test as it's shown in table (3-7-2-2), since LSD method assuming that variances between the studied groups are equal.

Multiple comparisons through applying LSD method are illustrated the statistical differences in table (4-7-2-2) between all probable contrast's groups, and as follows:

Table (3-7-2-2): Pair wise Comparisons by (LSD) test of Protrusion Parameter among studied sample's disorder and control group

Parameter	Group (I)	Group (J)	Mean Diff. (I-J)	Sig. (*)	LSD
Protrusion	Degenerative joint disease	Arthralgia	-0.650	0.038	0.31
		Intraarticular	-0.150	0.630	0.31
		Myofacial	0.350	0.262	0.31
		Headache	-0.400	0.200	0.31
		Control	-1.550	0.000	0.31
	Arthralgia	Intraarticular	0.500	0.110	0.31

		Myofacial	1.000	0.002	0.31
		Headache	0.250	0.422	0.31
		Control	-0.900	0.004	0.31
	Intraarticular	Myofacial	0.500	0.110	0.31
		Headache	-0.250	0.422	0.31
		Control	-1.400	0.000	0.31
	Myofacial	Headache	-0.750	0.017	0.31
		Control	-1.900	0.000	0.31
	Headache	Control	-1.150	0.000	0.31

(*) HS: Highly Sig. at P<0.01; S: Sig. at P<0.05; NS: No Sig. at P>0.05; Testing based on Least Significant Difference (LSD) test

Results shows mean differences, significant levels, and least significant differences of "Protrusion" parameter.

3.8 Distribution of Intraarticular disc disorder types

Table (3-8-1) shows a summary statistics of Distribution of the studied sample's disorder (Intraarticular disc disorder) according to (Intraarticular disc disorder with reduction, and intraarticular disc disorder with reduction with intermittent locking) with vast majority of patients with intraarticular disc disorder fall in first group.

Table (3-8-1): Distribution of the studied sample's disorder (Intraarticular disc disorder) according to (IADD, and IADDIL) with comparison's significant

Disorder	No. & %	IADD, and IADDIL		Total
		IADD	IADDIL	
Intraarticular disc disorders	No.	17	3	20
	%	85.0%	15%	100%
C.S. P-value		Binomial test P=0.003 HS		

(*)HS: Highly Sig. at P<0.01; Testing based on Binomial test

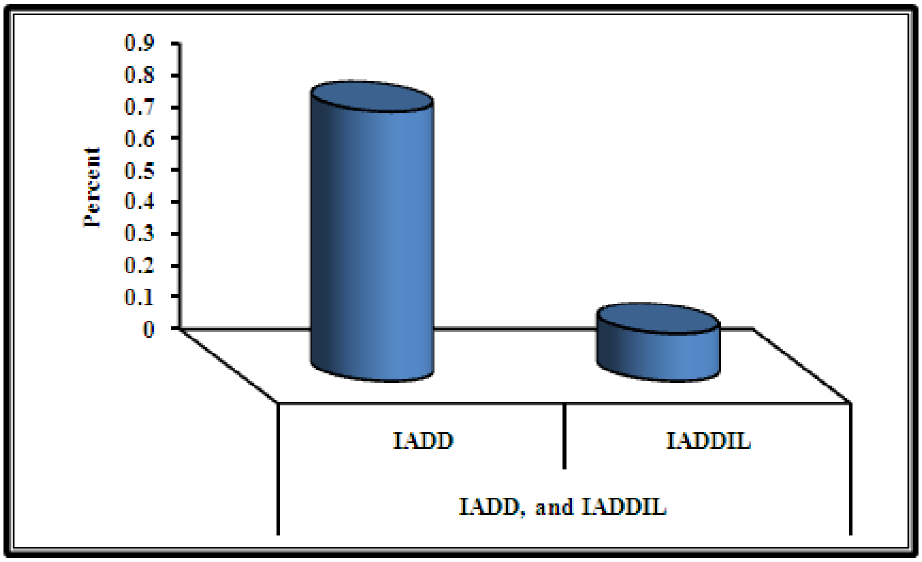


Figure (3-8-1): Distribution IADD, and IADDIL for the studied sample's Intraarticular Disorder

3.9 Image findings

Magnetic resonance image finding of intraarticular disc disorder

Table (3-9-1) shows a summary statistics of Distribution of the studied sample's disorder (Intraarticular disc disorder) according to MRI finding either presence or absence of anterior disc disorder in closed mouth with the result showed non-significant relationship.

Table (3-9-1): Distribution of the studied sample's disorder (Intraarticular) according to (Image Finding MRI) with comparison's significant

Disorder	No. & %	Image finding MRI		Total
		Anterior disk displacement	Normal	
Intraarticular	No.	12	8	20
	%	60%	40%	100%
C.S. P-value		P=0.503 NS		

(*)HS: Highly Sig. at P<0.01; Testing based on Binomial test

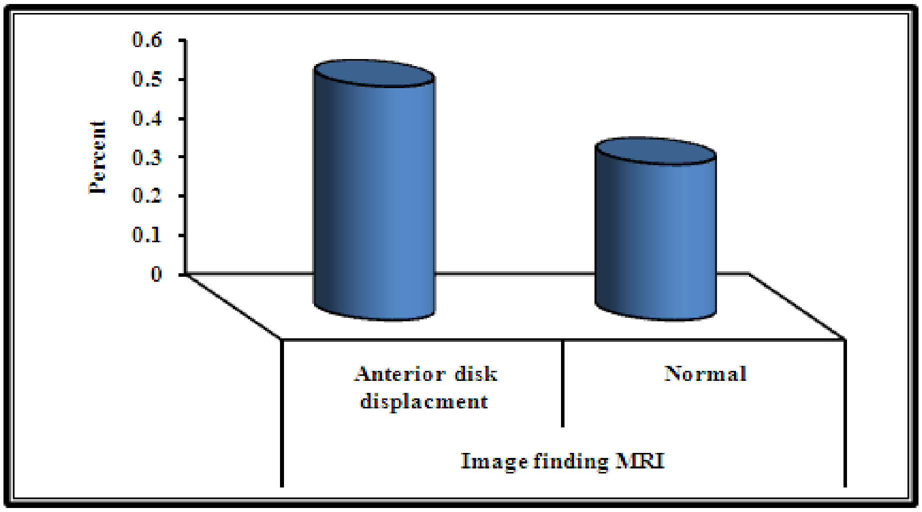


Figure (3-9-1): Distribution Image Finding MRI for the studied sample's Intraarticular Disorder

Computed Tomography findings

Table (3-9-2) shows a summary statistics of Distribution of the studied sample's disorder (Degenerative joint disease disorders) according to CT scan finding with the result showed non-significant relationship.

Table (3-9-2): Distribution of the studied sample's disorder (Degenerative joint disease) according to (Image finding CT) with comparison's significant

Disorder	No. & %	Image finding CT					Total
		flattening	Space narrowing	Subchondral thickening	Osteophyte formation	Erosion	
Osteoarthritis	No.	9	5	2	2	2	20
	%	45.0%	25.0%	10.0%	10.0%	10.0%	100%
C.S. P-value		K.S.=0.342 NS					

(*) NS: Non Sig. at P>0.05; Testing based on Kolmogorov- Smirnov test

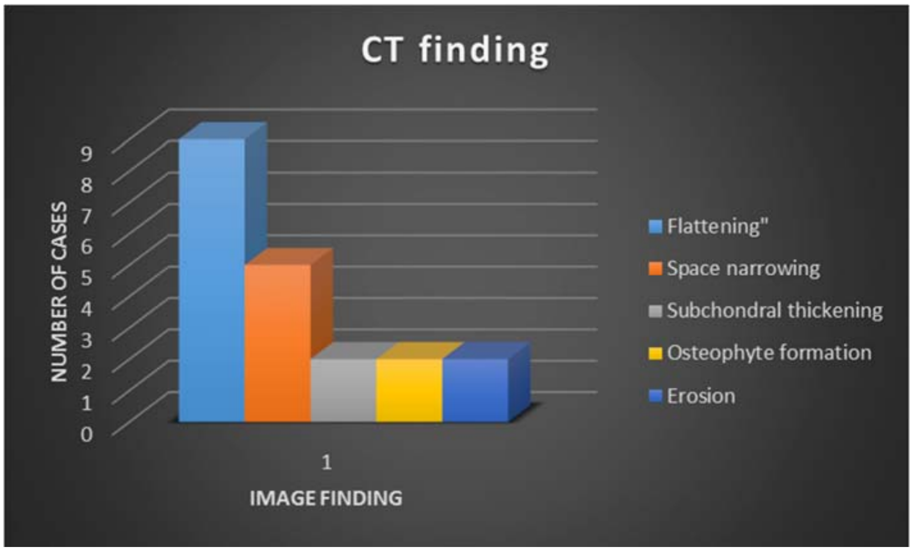


Figure (3-9-2): Distribution Image finding CT for the studied sample's Degenerative joint disease Disorder

3.10 Horizontal condylar inclination HCI and Transverse condylar inclination (TCI)

Table (3-10-1-1) shows a summary statistics of (HCI at 3 - right, HCI at 5 - right, HCI at 3 - Left, HCI at 5 – Left) parameters for the studied groups, such that, mean values, standard deviation, standard error, 95% confidence interval for the population mean, and the two extreme values (minimum, and maximum).

Table (3-10-1-1): Summary Statistics of different (HCI) Angular for studied sample's disorders and control groups

Angular	Disorders and Control Groups	No.	Mean	S.D.	S.E.	95% C.I. for Mean		Min.	Max.
						L.B.	U.B.		
HCI at 3 - right	Degenerative joint disease	20	40.85	8.60	1.92	36.83	44.87	26	60
	Arthralgia	20	46.20	9.00	2.01	41.99	50.41	32	60
	Intraarticular	20	44.65	7.63	1.71	41.08	48.22	32	60
	Myofascial	20	42.80	10.81	2.42	37.74	47.86	24	60
	Headache	20	44.00	8.71	1.95	39.93	48.07	28	60
	Control	20	49.25	10.44	2.33	44.36	54.14	24	60
HCI at 5 - right	Degenerative joint disease	20	39.95	7.94	1.77	36.24	43.66	24	60
	Arthralgia	20	44.45	8.44	1.89	40.50	48.40	31	60
	Intraarticular	20	43.70	7.26	1.62	40.30	47.10	30	60
	Myofascial	20	40.70	11.00	2.46	35.55	45.85	22	60
	Headache	20	41.30	9.88	2.21	36.67	45.93	28	60
	Control	20	48.65	9.64	2.15	44.14	53.16	27	60
HCI at 3 - left	Degenerative joint disease	20	40.85	10.38	2.32	35.99	45.71	25	60
	Arthralgia	20	42.95	7.24	1.62	39.56	46.34	30	57
	Intraarticular	20	43.30	9.27	2.07	38.96	47.64	29	60
	Myofascial	20	40.85	7.75	1.73	37.22	44.48	28	57
	Headache	20	43.40	9.76	2.18	38.83	47.97	27	60
	Control	20	48.05	9.32	2.08	43.69	52.41	27	60
HCI at 5 - left	Degenerative joint disease	20	40.75	11.45	2.56	35.39	46.11	23	60
	Arthralgia	20	41.35	6.35	1.42	38.38	44.32	30	51
	Intraarticular	20	42.55	9.19	2.06	38.25	46.85	30	60
	Myofascial	20	38.70	7.62	1.70	35.14	42.26	26	54
	Headache	20	40.35	9.18	2.05	36.05	44.65	25	59
	Control	20	47.00	8.63	1.93	42.96	51.04	31	60

Regarding to HCI at 3 - right, Degenerative joint disease group had recorded low mean value, then followed by Myofascial, group, while high levels are recorded by Arthralgia, even though vast majority are recorded within controlled group.

On the subject HCI at 5 - right, Degenerative joint disease group had recorded low mean value, then followed by Myofascial, and Headache groups, while high levels are recorded by Arthralgia, even though vast majority are recorded within controlled group.

With respect to HCI at 3 - left, Degenerative joint disease, and Myofascial groups had recorded low mean values, then followed by Intraarticular, and Arthralgia groups, while high levels are recorded by Headache, even though vast majority are recorded within controlled group.

Finally, regarding to HCI at 5 - left, Myofascial group had recorded low mean value, then followed by Headache, and Degenerative joint disease groups, while high levels are recorded by Arthralgia, even though vast majority are recorded within controlled group.

Figure (3-10-1-1) represents graphically plotting bar charts of the mean values of (HCI at 3 - right, HCI at 5 - right, HCI at 3 - Left, HCI at 5 – Left) parameters for the studied groups.

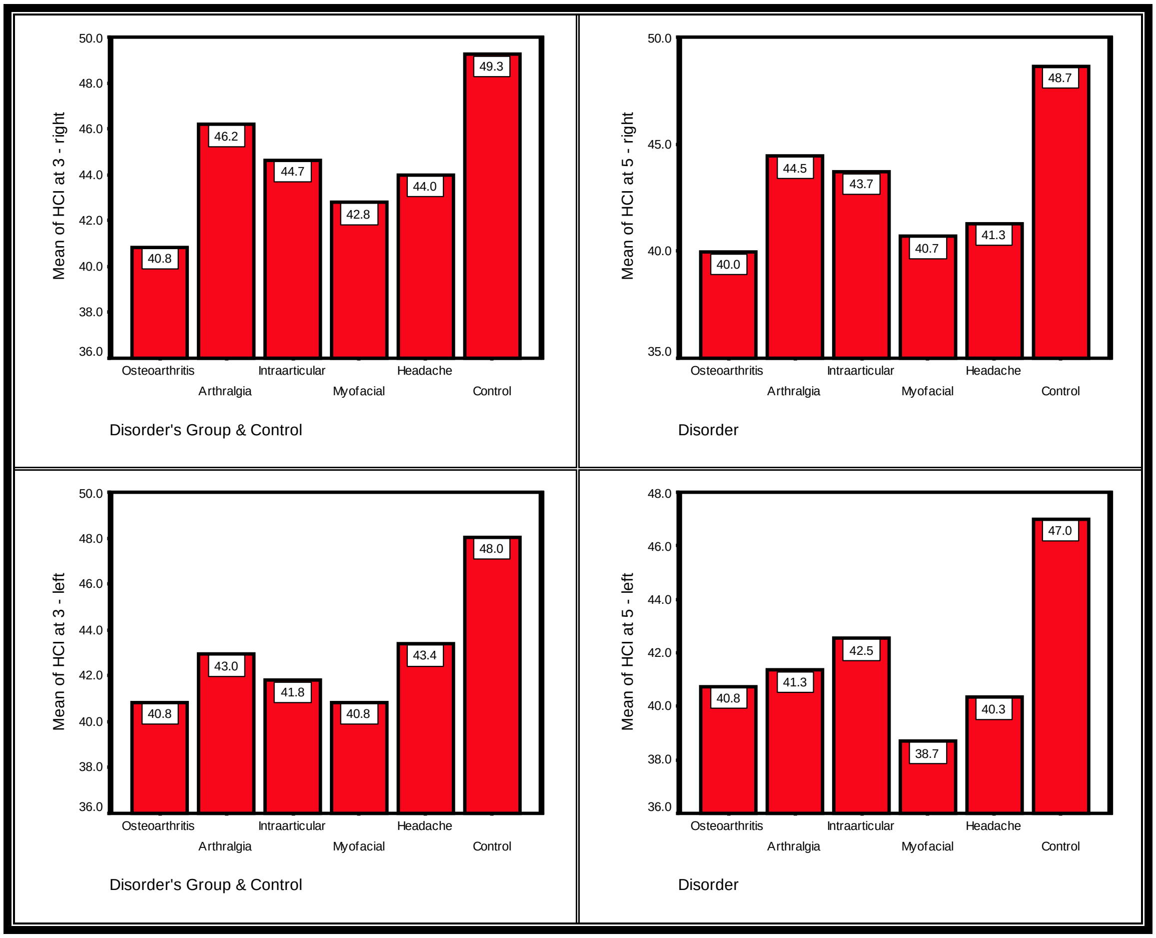


Figure (3-10-1-1): Distribution of HCI Angular for studied sample's disorders and control groups

With respect to test statistical hypotheses, which says that group's readings concerning (HCI at 3 - right, HCI at 5 - right, HCI at 3 - Left, HCI at 5 – Left) parameters are thrown from the same population, and that should be proved according to equality of variances and equality of means by applying "Levene and one-way ANOVA respectively, and as illustrated in table (3-10-1-2).

Table (3-10-1-2): Testing HCI parameter of different sits according to equality of variances and equality of mean values

Mouth Opening	Testing Homogeneity of Variances		ANOVA- Testing equality of means	
	Levene Statistic	Sig. (*)	F	Sig. (*)
HCI at 3 - right	0.853	0.515 NS	1.950	0.091 NS
HCI at 5 - right	1.466	0.206 NS	2.498	0.035 S
HCI at 3 - left	0.898	0.485 NS	1.704	0.139 NS
HCI at 5 - left	1.810	0.116 N S	2.062	0.075 NS

(*) HS : Highly Significant at P< 0.01; ; S: Sig. at P<0.05; NS: No Sig. at P>0.05

No significant different at P>0.05 had been registered in testing equality of means, except with HCI at 5 - right parameter, which reported significant different at P<0.05, as well as no significant differences for testing of equality of variances. The obvious results needs to be continuing the test through applying least significant difference (LSD) test as it's shown in table (3-10-2-3), since LSD method assuming that variances between the studied groups are equal.

Multiple comparisons through applying LSD method are illustrated the statistical differences for Mediotrusion parameter between all probable contrast's groups, and as follows:

Table (3-10-1-3): Pair wise Comparisons by (LSD, and GH) tests of HCI Angular among studied sample's disorder and control group

HCI Angular	Group (I)	Group (J)	Mean Diff. (I-J)	Sig. (*)	LSD & GH
HCI at 3 - right	Degenerative joint disease	Arthralgia	-5.35	0.070	5.80
		Intraarticular	-3.8	0.197	5.80
		Myofacial	-1.95	0.507	5.80
		Headache	-3.15	0.285	5.80
		Control	-8.4	0.005	5.80
	Arthralgia	Intraarticular	1.55	0.598	5.80
		Myofacial	3.4	0.248	5.80
		Headache	2.2	0.454	5.80
		Control	-3.05	0.300	5.80
	Intraarticular	Myofacial	1.85	0.529	5.80
		Headache	0.65	0.825	5.80
		Control	-4.6	0.119	5.80
	Myofacial	Headache	-1.2	0.683	5.80
		Control	-6.45	0.030	5.80
	Headache	Control	-5.25	0.076	5.80
HCI at 5 - right	Osteoarthritis	Arthralgia	-2.10	0.463	5.65
		Intraarticular	-2.45	0.392	5.65
		Myofacial	0.00	1.000	5.65
		Headache	-2.55	0.373	5.65
		Control	-7.20	0.013	5.65
	Arthralgia	Intraarticular	-0.35	0.903	5.65
		Myofacial	2.10	0.463	5.65
		Headache	-0.45	0.875	5.65
		Control	-5.10	0.076	5.65
	Intraarticular	Myofacial	2.45	0.392	5.65
		Headache	-0.10	0.972	5.65
		Control	-4.75	0.099	5.65
	Myofacial	Headache	-2.55	0.373	5.65
		Control	-7.20	0.013	5.65
	Headache	Control	-4.65	0.106	5.65
HCI at	Degenerative joint disease	Arthralgia	-2.1	0.495	6.08
		Intraarticular	-0.95	0.758	6.08

3 - left		Myofacial	0	1.000	6.08
		Headache	-2.55	0.408	6.08
		Control	-7.2	0.021	6.08
	Arthralgia	Intraarticular	1.15	0.709	6.08
		Myofacial	2.1	0.495	6.08
		Headache	-0.45	0.884	6.08
		Control	-5.1	0.100	6.08
	Intraarticular	Myofacial	0.95	0.758	6.08
		Headache	-1.6	0.603	6.08
		Control	-6.25	0.044	6.08
	Myofacial	Headache	-2.55	0.408	6.08
		Control	-7.2	0.021	6.08
	Headache	Control	-4.65	0.133	6.08

HCI Angular	Group (I)	Group (J)	Mean Diff. (I-J)	Sig. (*)	LSD & GH
HCI at 5 - left	Degenerative joint disease	Arthralgia	-0.60	0.831	5.56
		Intraarticular	-1.80	0.523	5.56
		Myofacial	2.05	0.467	5.56
		Headache	0.40	0.887	5.56
		Control	-6.25	0.028	5.56
	Arthralgia	Intraarticular	-1.20	0.670	5.56
		Myofacial	2.65	0.347	5.56
		Headache	1.00	0.722	5.56
		Control	-5.65	0.047	5.56
	Intraarticular	Myofacial	3.85	0.173	5.56
		Headache	2.20	0.435	5.56
		Control	-4.45	0.116	5.56
	Myofacial	Headache	-1.65	0.558	5.56
		Control	-8.30	0.004	5.56
	Headache	Control	-6.65	0.020	5.56

(*) HS: Highly Sig. at P<0.01; S: Sig. at P<0.05; NS: No Sig. at P>0.05; Testing based on Least Significant Difference (LSD), and Games Howell (GH) tests

Results shows mean differences, significant levels, and least significant differences e for (HCI at 3 - right, HCI at 5 - right, HCI at 3 - Left, HCI at 5 – Left) parameters.

Table (3-9-2-1) shows a summary statistics of (TCI at 3 - right, TCI at 5 - right, TCI at 3 - Left, TCI at 5 – Left) parameters for the studied groups, such that, mean values, standard deviation, standard error, 95% confidence interval for the population mean, and the two extreme values (minimum, and maximum).

Table (3-10-2-1): Summary Statistics of different (TCI) Angular for studied sample's disorders and control groups

Angular	Disorders and Control Groups	No.	Mean	S.D.	S.E.	95% C.I. for Mean		Min.	Max.
						L.B.	U.B.		
TCI at 3 - right	Degenerative joint disease	20	6.45	2.50	0.56	5.28	7.62	5	13
	Arthralgia	20	6.75	2.34	0.52	5.66	7.84	5	12
	Intraarticular	20	6.40	1.54	0.34	5.68	7.12	5	10
	Myofacial	20	6.40	1.50	0.34	5.70	7.10	5	10
	Headache	20	7.35	3.30	0.74	5.81	8.89	5	15
	Control	20	8.00	3.09	0.69	6.55	9.45	5	15
TCI at 5 - right	Degenerative joint disease	20	5.95	1.93	0.43	5.05	6.85	5	12
	Arthralgia	20	6.15	1.69	0.38	5.36	6.94	5	10
	Intraarticular	20	6.15	1.31	0.29	5.54	6.76	5	8
	Myofacial	20	6.50	1.79	0.40	5.66	7.34	5	12
	Headache	20	7.00	3.37	0.75	5.42	8.58	5	15
	Control	20	7.35	2.27	0.51	6.19	8.31	5	12
TCI at 3 - left	Degenerative joint disease	20	6.60	2.98	0.67	5.21	7.99	0	14
	Arthralgia	20	6.10	2.13	0.48	5.11	7.09	5	12
	Intraarticular	20	6.65	1.98	0.44	5.72	7.58	5	10
	Myofascial	20	5.90	2.57	0.58	4.70	7.10	0	13
	Headache	20	5.75	2.17	0.49	4.73	6.77	0	12
	Control	20	7.85	3.22	0.72	6.34	9.36	5	15
TCI at 5 - left	Degenerative joint disease	20	6.25	2.69	0.60	4.99	7.51	0	13
	Arthralgia	20	5.85	1.63	0.36	5.09	6.61	5	10
	Intraarticular	20	6.65	2.08	0.47	5.67	7.63	5	12
	Myofascial	20	5.75	2.57	0.58	4.55	6.95	0	12
	Headache	20	5.70	1.98	0.44	4.78	6.62	0	10
	Control	20	7.25	2.24	0.50	6.20	8.30	5	12

Regarding to HCI at 3 - right, Myofascial, Intraarticular groups had recorded low mean value, then followed by others groups, and high level are recorded by Headache group, even though vast majority are recorded within controlled group.

On the subject HCI at 5 - right, Arthralgia, and Intraarticular groups had recorded low mean value, then followed by Degenerative joint disease group, while high levels are recorded by Headache group, even though vast majority are recorded within controlled group.

With respect to HCI at 3 - left, Headache, and Myofascial groups had recorded low mean values, then followed by Arthralgia, and Degenerative joint disease groups, while high levels are recorded by Intraarticular, even though vast majority are recorded within controlled group.

Finally, regarding to HCI at 5 - left, Headache group had recorded low mean value, then followed by Myofascial, and Arthralgia groups, while high levels are recorded by Intraarticular, even though vast majority are recorded within controlled group.

Figure (3-10-2-1) represents graphically plotting bar charts of the mean values of (HCI at 3 - right, HCI at 5 - right, HCI at 3 - Left, HCI at 5 – Left) parameters for the studied groups.

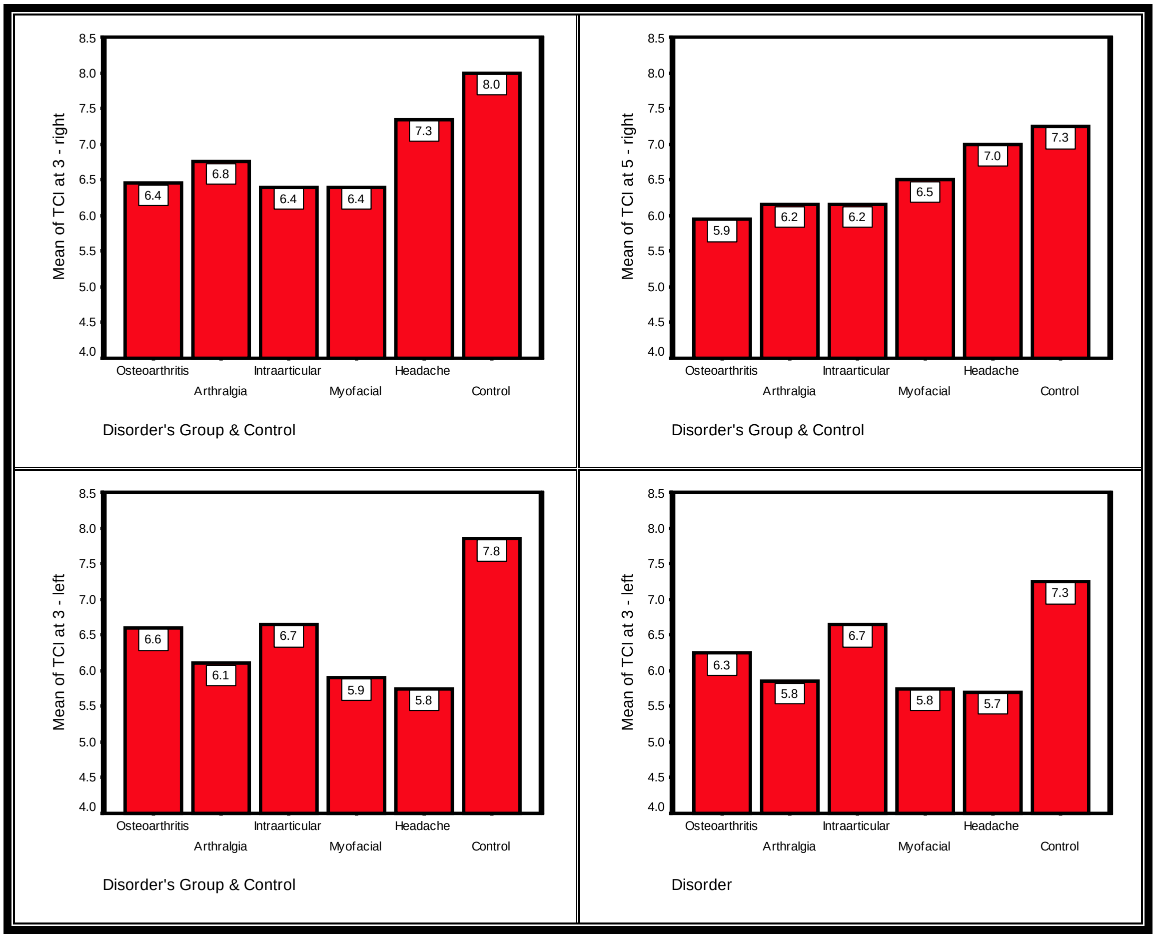


Figure (3-10-3-1): Distribution of TCI Angular for studied sample's disorders and control groups

With respect to test statistical hypotheses, which says that group's readings concerning (TCI at 3 - right, TCI at 5 - right, TCI at 3 - Left, TCI at 5 – Left) parameters are thrown from the same population, and that should be proved according to equality of variances and equality of means by applying "Levene and one-way ANOVA respectively, and as illustrated in table (3-10-2-2).

Table (3-10-2-2): Testing HCI and TCI Parameters according to equality of variances and equality of means

Mouth Opening	Testing Homogeneity of Variances		ANOVA- Testing equality of means	
	Levene Statistic	Sig. (*)	F	Sig. (*)
TCI at 3 – right	4.660	0.001 HS	1.394	0.232 NS
TCI at 5 - right	3.280	0.008 HS	1.164	0.331 NS
TCI at 3 - left	1.695	0.141 NS	1.805	0.117 NS
TCI at 3 - left	0.773	0.571 NS	1.507	0.193 NS

(*) HS: Highly Significant at P< 0.01; ; S: Sig. at P<0.05; NS: No Sig. at P>0.05

No significant different at P>0.05 had been registered in testing equality of means, as well as no significant differences for testing of equality of variances within (TCI at 3 - Left, TCI at 5 – Left) parameters, while highly significant differences at P<0.01 are accounted within (TCI at 3 - right, TCI at 5 - right) parameters. The results needs to be continuing the test through applying least significant difference (LSD) test, and Games Howell (GH) test, since LSD method assuming that variances between the studied groups are equal, while (GH) method assuming that variances between the studied groups are not equal, and as illustrated in table (3-10-2-3).

Table (3-10-2-3): Pair wise Comparisons by (LSD, and GH) tests of TCI Angular among studied sample's disorder and control group

TCI Angular	Group (I)	Group (J)	Mean Diff. (I-J)	Sig. (*)	LSD & GH
TCI at 3 - right	Degenerative joint disease	Arthralgia	-0.30	0.999	2.30
		Intraarticular	0.05	1.000	1.99
		Myofascial	0.05	1.000	1.98
		Headache	-0.90	0.924	2.79
		Control	-1.55	0.514	2.68
	Arthralgia	Intraarticular	0.35	0.993	1.89
		Myofascial	0.35	0.993	1.88
		Headache	-0.60	0.985	2.73
		Control	-1.25	0.702	2.61

	Intraarticular	Myofascial	0.00	1.000	1.44
		Headache	-0.95	0.848	2.49
		Control	-1.60	0.331	2.36
	Myofascial	Headache	-0.95	0.846	2.48
		Control	-1.60	0.326	2.35
	Headache	Control	-0.65	0.987	3.03
TCI at 5 - right	Degenerative joint disease	Arthralgia	-0.20	0.999	1.73
		Intraarticular	-0.20	0.999	1.58
		Myofascial	-0.55	0.935	1.77
		Headache	-1.05	0.829	2.64
		Control	-1.30	0.389	2.00
	Arthralgia	Intraarticular	0.00	1.000	1.44
		Myofascial	-0.35	0.988	1.65
		Headache	-0.85	0.912	2.58
		Control	-1.10	0.517	1.91
	Intraarticular	Myofascial	-0.35	0.980	1.50
		Headache	-0.85	0.896	2.50
		Control	-1.10	0.434	1.78
	Myofascial	Headache	-0.50	0.991	2.60
		Control	-0.75	0.852	1.94
	Headache	Control	-0.25	1.000	2.75
TCI at 3 - left	Degenerative joint disease	Arthralgia	0.50	0.536	1.60
		Intraarticular	-0.05	0.951	1.60
		Myofascial	0.70	0.387	1.60
		Headache	0.85	0.294	1.60
		Control	-1.25	0.124	1.60
	Arthralgia	Intraarticular	-0.55	0.497	1.60
		Myofascial	0.20	0.805	1.60
		Headache	0.35	0.665	1.60
		Control	-1.75	0.032	1.60
	Intraarticular	Myofascial	0.75	0.354	1.60
		Headache	0.90	0.267	1.60
		Control	-1.20	0.139	1.60
	Myofascial	Headache	0.15	0.853	1.60
		Control	-1.95	0.017	1.60
	Headache	Control	-2.10	0.010	1.60

Continues …

TCI Angular	Group (I)	Group (J)	Mean Diff. (I-J)	Sig. (*)	LSD & GH
TCI at 5 - left	Degenerative joint disease	Arthralgia	0.40	0.572	1.40
		Intraarticular	-0.40	0.572	1.40
		Myofascial	0.50	0.480	1.40
		Headache	0.55	0.437	1.40
		Control	-1.00	0.159	1.40
	Arthralgia	Intraarticular	-0.80	0.259	1.40
		Myofascial	0.10	0.887	1.40
		Headache	0.15	0.832	1.40
		Control	-1.40	0.049	1.40
	Intraarticular	Myofascial	0.90	0.204	1.40
		Headache	0.95	0.180	1.40
		Control	-0.60	0.396	1.40
	Myofascial	Headache	0.05	0.944	1.40
		Control	-1.50	0.036	1.40
	Headache	Control	-1.55	0.030	1.40

(*) HS: Highly Sig. at P<0.01; S: Sig. at P<0.05; NS: No Sig. at P>0.05; Testing based on Least Significant Difference (LSD), and Games Howell (GH) tests

Results shows mean differences, significant levels, and least significant differences for (TCI at 3 - right, TCI at 5 - right, TCI at 3 - Left, TCI at 5 – Left) parameters.

Table (3-10-3-1) shows a summary statistics in different (HCI, and TCI) parameters concerning Intraarticular disorder group, in light of IADD, and IADDIL such that, mean values, standard deviation, standard error, 95% confidence interval for the population mean, and the two extreme values (minimum, and maximum), as well as comparisons significant for testing equality of variances and equality of means by applying "Levene and student t-tests respectively.

Table (3-10-3-1): Summary Statistics of different (HCI, and TCI) Angular in studied Intraarticular disorder group

Parameters	Resp.	No.	Mean	S.D.	S.E.	Levene's Test for Equality of Variances		t-test for Equality of Means		
						F-value	Sig.	t-value	df	Sig. (2-tailed)
HCI at 3 - right	IADD	17	44.41	7.7	1.87	0.069	0.795	-0.324	18	0.749 NS
	IADDIL	3	46	8.72	5.03					
HCI at 5 - right	IADD	17	43.18	7.52	1.82	0.337	0.569	-0.759	18	0.458 NS
	IADDIL	3	46.67	5.77	3.33					
HCI at 3 - left	IADD	17	42.59	9.83	2.38	1.895	0.185	-0.810	18	0.428 NS
	IADDIL	3	47.33	3.79	2.19					
HCI at 5 - left	IADD	17	41.59	9.40	2.28	0.775	0.390	-1.122	18	0.277 NS
	IADDIL	3	48	6.56	3.79					
TCI at 3 - right	IADD	17	6.29	1.53	0.37	0.010	0.922	-0.725	18	0.478 NS
	IADDIL	3	7	1.73	1					
TCI at 5 - right	IADD	17	6.18	1.29	0.31	0.332	0.571	0.21	18	0.836 NS
	IADDIL	3	6	1.73	1					
TCI at 3 - left	IADD	17	6.47	1.91	0.46	0.010	0.922	-0.962	18	0.349 NS
	IADDIL	3	7.67	2.52	1.45					
TCI at 3 - left	IADD	17	6.47	2.03	0.49	0.006	0.941	-0.912	18	0.374 NS
	IADDIL	3	7.67	2.52	1.45					

(*) **NS: No Sig. at P>0.05; Testing based on Levene, and Student t-tests.**

With respect to testing equality of variances, results showed that no significant differences are accounted at P>0.05 between IADD, and IADDIL group's variances of studied parameters, as well as no significant differences are accounted at P>0.05 between IADD, and IADDIL throughout equal mean values of studied parameters.

Table (3-10-3-2) shows a summary statistics in different (HCI, and TCI) parameters concerning Intraarticular disorder group, in light of ADD, and Normal such that, mean values, standard deviation, standard error, as well as comparisons significant for testing equality of variances and equality of means by "Levene and student t-tests respectively.

Table (3-10-3-2): Summary Statistics of different (HCI, and TCI) Angular in studied Intraarticular disorder group

Parameters	Resp.	No.	Mean	S.D.	S.E.	Levene's Test for Equality of Variances		t-test for Equality of Means		
						F-value	Sig.	t-value	df	Sig. (2-tailed)
HCI at 3 - right	ADD	12	45.25	7.35	2.12	0.122	0.731	0.421	18	0.679 NS
	Normal	8	43.75	8.46	2.99					
HCI at 5 - right	ADD	12	43.75	6.24	1.8	1.886	0.187	0.037	18	0.971 NS
	Normal	8	43.63	9.05	3.2					
HCI at 3 - left	ADD	12	43.92	9.77	2.82	0.469	0.502	0.902	18	0.379 NS
	Normal	8	38.63	16.57	5.86					
HCI at 5 - left	ADD	12	43.42	9.61	2.77	0.433	0.519	1.027	18	0.318 NS
	Normal	8	37.5	16.26	5.75					
TCI at 3 - right	ADD	12	6.17	1.34	0.39	1.003	0.330	-0.825	18	0.420 NS
	Normal	8	6.75	1.83	0.65					
TCI at 5 - right	ADD	12	5.92	1.24	0.36	0.600	0.449	-0.975	18	0.342 NS
	Normal	8	6.5	1.41	0.5					
TCI at 3 - left	ADD	12	6.42	1.83	0.53	1.280	0.273	-0.635	18	0.533 NS
	Normal	8	7	2.27	0.8					
TCI at 3 - left	ADD	12	6.42	1.83	0.53	0.646	0.432	-0.603	18	0.554 NS
	Normal	8	7	2.51	0.89					

(*) NS: No Sig. at P>0.05; Testing based on Levene, and Student t-tests.

ADD: Anterior disk displacement

With respect to testing equality of variances, results showed that no significant differences are accounted at P>0.05 between ADD, and Normal group's variances of studied parameters, as well as no significant differences are accounted at P>0.05 between ADD, and Normal throughout equal mean values of studied parameters.

Table (3-10-4-1) shows a summary statistics in different (HCI) parameters concerning Degenerative joint disease disorder group, in light of Image finding CT diagnosis such that, mean values, standard deviation, standard error, as well as comparisons significant for testing equality of variances and equality of means by "Levene and ANOVA tests respectively.

Table (3-10-4-1): Summary Statistics of HCI parameters concerning Image finding CT diagnosis for studied Degenerative joint disorder group

Parameter	Disorders and Control Groups	No.	Mean	S.D.	S.E.	Levene test F value	Levene test P value	ANOVA F value	ANOVA P value
HCI at 3 - right	Flattening	9	41.8	8.0	2.8	1.001	0.438 NS	0.807	0.539 NS
	Space narrowing	5	37.6	8.7	3.9				
	Subchondral thickening	2	37.0	-	-				
	Osteophyte formation	2	36.0	0.0	0.0				
	Erosion	2	46.5	11.6	5.8				
HCI at 5 - right	Flattening	9	42.1	5.6	2.0	1.469	0.261 NS	1.106	0.390 NS
	Space narrowing	5	35.8	8.8	3.9				
	Subchondral thickening	2	38.0	-	-				
	Osteophyte formation	2	34.0	1.4	1.0				
	Erosion	2	44.3	11.4	5.7				
HCI at 3 - left	Flattening	9	45.1	8.8	3.1	2.039	0.140 NS	1.862	0.170 NS
	Space narrowing	5	35.4	10.4	4.7				
	Subchondral thickening	2	38.0	-	-				
	Osteophyte formation	2	29.0	0.0	0.0				
	Erosion	2	45.8	11.5	5.8				
HCI at 5 - left	Flattening	9	46.0	8.7	3.1	2.471	0.089 NS	1.419	0.276 NS
	Space narrowing	5	35.2	10.6	4.7				

	Subchondral thickening	2	39.0	-	-				
	Osteophyte formation	2	29.0	2.8	2.0				
	Erosion	2	43.5	16.6	8.3				

(*) NS: No Sig. at P>0.05; Testing based on Levene, and ANOVA tests.

With respect to testing equality of variances, and equality of mean values, results showed that no significant differences are accounted at P>0.05 among Image finding CT diagnoses either for variances or for mean values at P>0.05.

Table (3-10-4-2) shows a summary statistics in different (TCI) parameters concerning Degenerative joint disease disorder group, in light of Image finding CT diagnosis such that, mean values, standard deviation, standard error, as well as comparisons significant for testing equality of variances and equality of means by "Levene and ANOVA tests respectively.

Table (3-10-4-2): Summary Statistics of TCI parameters concerning Image finding CT diagnosis for studied Degenerative joint disease disorder group

Parameter	Image finding CT	No.	Mean	S.D.	S.E.	Levene test		ANOVA	
						F value	P value	F value	P value
TCI at 3 - right	Flattening	9	5.4	0.7	0.3	4.229	0.089 NS	1.581	0.230 NS
	Space narrowing	5	8.2	3.4	1.5				
	Subchondral thickening	2	5.0	.	.				
	Osteophyte formation	2	5.0	0.0	0.0				
	Erosion	2	7.5	3.3	1.7				
TCI at 5 - right	Flattening	9	5.3	0.5	0.2	19.36	0.000 HS	1.228	0.341 NS
	Space narrowing	5	7.4	3.4	1.5				
	Subchondral thickening	2	5.0	.	.				
	Osteophyte formation	2	5.0	0.0	0.0				

	Erosion	**2**	**6.3**	**1.5**	**0.8**				
TCI at 3 - left	**Flattening**	**9**	**6.8**	**2.3**	**0.8**	**0.874**	**0.503 NS**	**1.516**	**0.248 NS**
	Space narrowing	**5**	**6.6**	**2.6**	**1.2**				
	Subchondral thickening	**2**	**6.0**	**.**	**.**				
	Osteophyte formation	**2**	**2.5**	**3.5**	**2.5**				
	Erosion	**2**	**8.5**	**3.9**	**1.9**				
TCI at 3 - left	**Flattening**	**9**	**6.3**	**1.5**	**0.5**	**3.105**	**0.045 S**	**1.277**	**0.322 NS**
	Space narrowing	**5**	**7.0**	**2.7**	**1.2**				
	Subchondral thickening	**2**	**6.0**	**.**	**.**				
	Osteophyte formation	**2**	**2.5**	**3.5**	**2.5**				
	Erosion	**2**	**7.3**	**3.9**	**1.9**				

(*) NS: No Sig. at P>0.05; Testing based on Levene, and ANOVA tests.

With respect to testing equality of variances, and equality of mean values, results showed that no significant differences are accounted at P>0.05 among Image finding CT diagnoses either for variances or for mean values at P>0.05.

Table (3-10-5-1) shows a summary statistics in different (HCI) parameters concerning Myofascial disorder group, in light of Muscle involved diagnoses such that, mean values, standard deviation, standard error, as well as comparisons significant for testing equality of variances and equality of means by "Levene and ANOVA tests respectively.

Table (3-10-5-1): Summary Statistics of HCI parameters concerning Muscle involved diagnosis for studied Myofascial disorder group

Parameters	Resp.	No.	Mean	S.D.	S.E.	Levene's Test for Equality of Variances		t-test for Equality of Means		
						F-value	Sig.	t-value	df	Sig. (2-tailed)
HCI at 3 - right	M.I. (M)	16	40.94	10.99	2.75	1.184	0.292 NS	-1.481	17	0.157 NS
	M.I (T)	4	50.25	6.65	3.33					
HCI at 5 - right	M.I. (M)	16	38.81	11.17	2.79	0.881	0.361 NS	-1.485	17	0.156 NS
	M.I (T)	4	48.25	6.9	3.45					
HCI at 3 - left	M.I. (M)	16	39.94	8.3	2.07	2.963	0.103 NS	-0.908	17	0.377 NS
	M.I (T)	4	44.5	3.79	1.89					
HCI at 5 - left	M.I. (M)	16	37.75	8.15	2.04	3.242	0.090 NS	-0.978	17	0.342 NS
	M.I (T)	4	42.5	3.32	1.66					

With respect to testing equality of variances, and equality of mean values, results showed that no significant differences are accounted at P>0.05 among Muscle involved diagnoses either for variances or for mean values at P>0.05 concerning Myofascial disorder group.

Figure (3-10-5-1) represents graphically plotting bar charts of the mean values of HCI parameters concerning Muscle involved diagnosis for studied Myofascial disorder group.

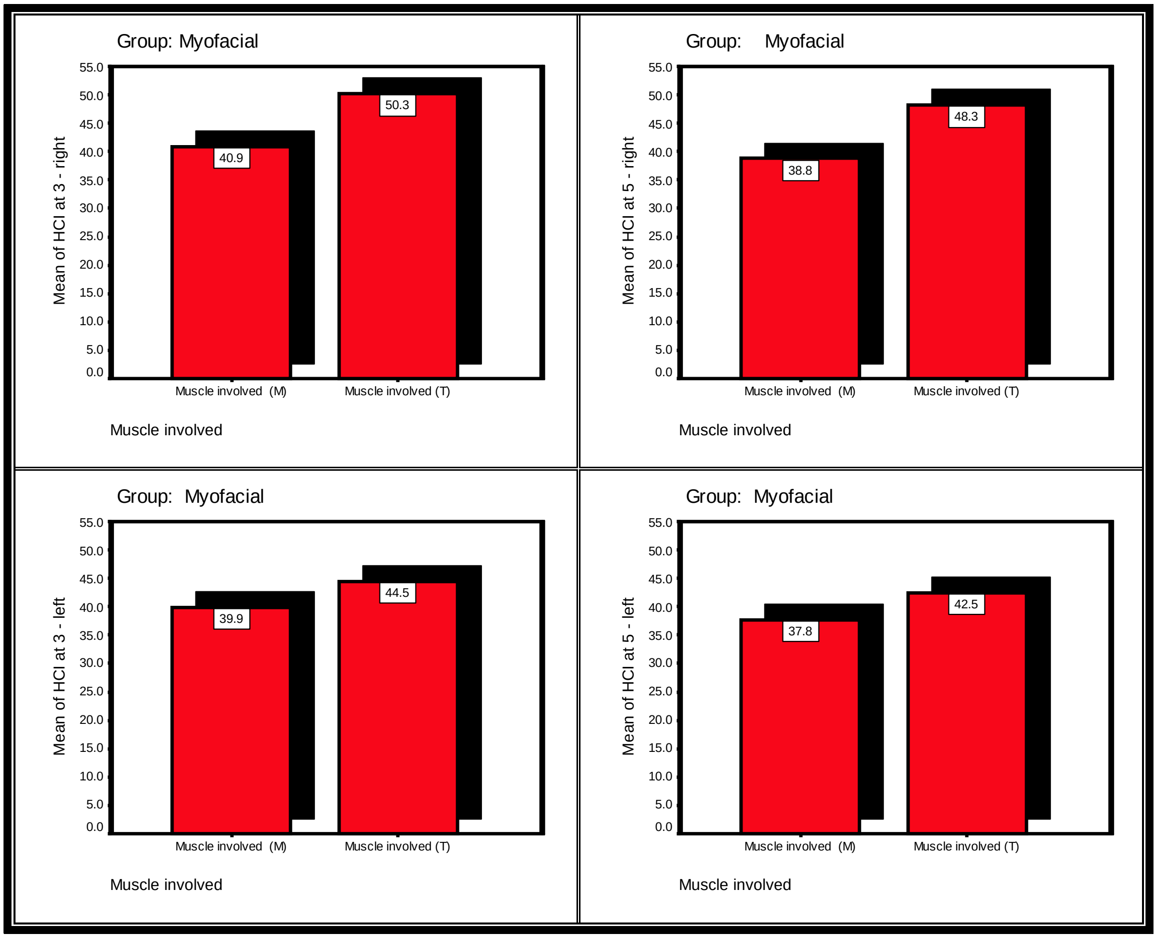


Figure (3-10-5-1): Bar charts plot of mean values of HCI parameters concerning Muscle involved diagnoses for studied Myofascial disorder group

Table (3-10-5-2) shows a summary statistics in different (TCI) parameters concerning Myofascial disorder group, in light of Muscle involved diagnoses such that, mean values, standard deviation, standard error, as well as comparisons significant for testing equality of variances and equality of means by "Levene and ANOVA tests respectively.

Table (3-10-5-2): Summary Statistics of TCI parameters concerning Muscle involved diagnosis for studied Myofascial disorder group

Parameters	Resp.	No.	Mean	S.D.	S.E.	Levene's Test for Equality of Variances		t-test for Equality of Means		
						F-value	Sig.	t-value	df	Sig. (2-tailed)
TCI at 3 - right	M.I. (M)	16	6.31	1.54	0.38	0.012	0.914 NS	-0.644	17	0.528 NS
	M.I (T)	4	6.75	1.5	0.75					
TCI at 5 - right	M.I. (M)	16	6.44	1.9	0.47	0.038	0.849 NS	-0.401	17	0.694 NS
	M.I (T)	4	6.75	1.5	0.75					
TCI at 3 - left	M.I. (M)	16	5.81	2.66	0.67	0.002	0.961 NS	-0.252	17	0.804 NS
	M.I (T)	4	6.25	2.5	1.25					
TCI at 3 - left	M.I. (M)	16	5.5	2.37	0.59	1.209	0.287 NS	-0.812	17	0.428 NS
	M.I (T)	4	6.75	3.5	1.75					

(*) NS: No Sig. at P>0.05; Testing based on Levene, and Student t-tests.

With respect to testing equality of variances, and equality of mean values, results showed that no significant differences are accounted at P>0.05 among Muscle involved diagnoses either for variances or for mean values at P>0.05 concerning Myofascial disorder group.

Figure (3-10-5-2) represents graphically plotting bar charts of the mean values of HCI parameters concerning Muscle involved diagnosis for studied Myofascial disorder group.

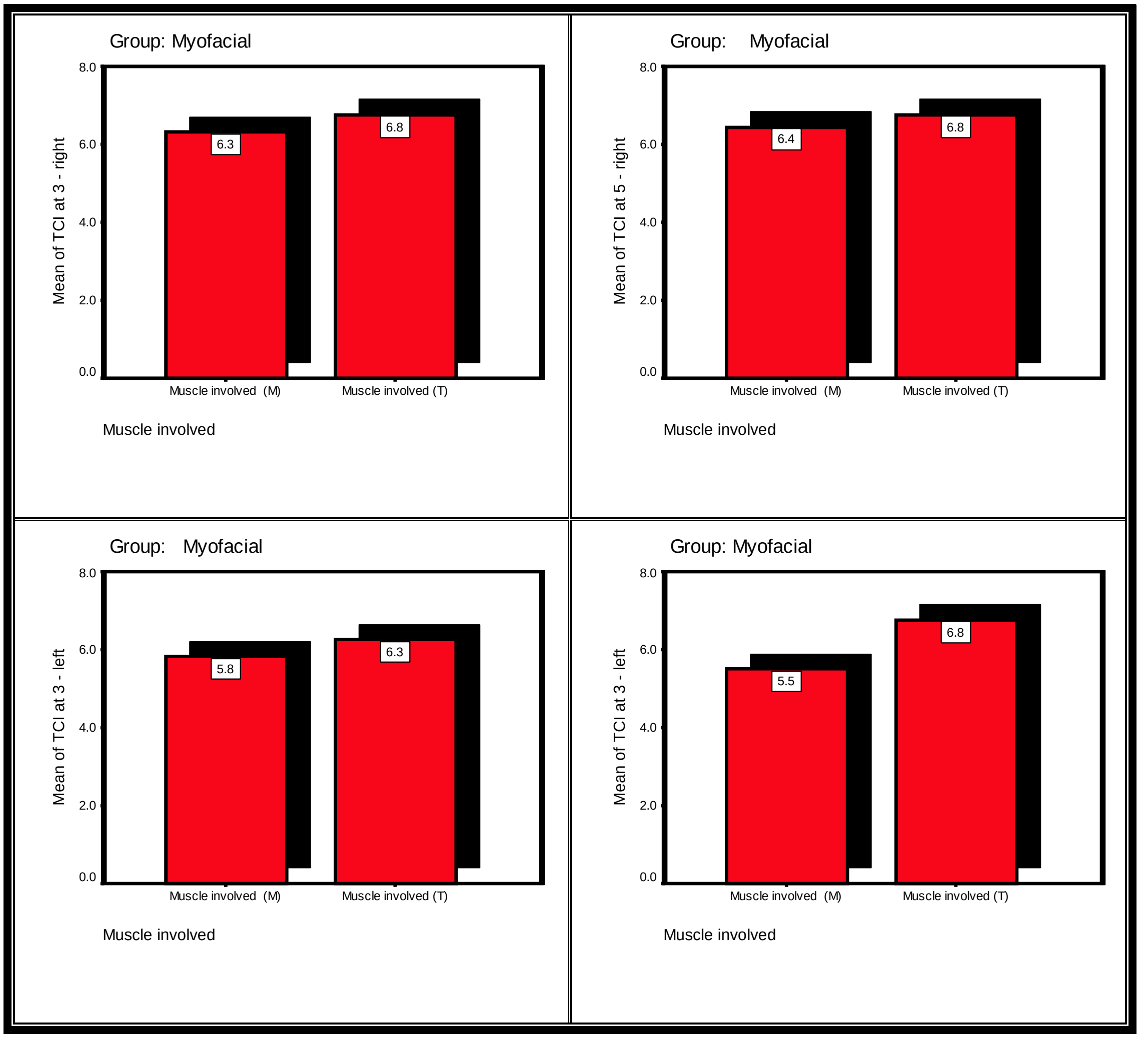


Figure (3-10-5-2): Bar charts plot of mean values of TCI parameters concerning Muscle involved diagnoses for studied Myofascial disorder group

Table (3-10-5-3) shows a summary statistics in different (HCI) parameters concerning Headache disorder group, in light of Muscle involved diagnoses M.I. (T), and M.I (M+T)), such that "mean values, standard deviation, standard error", as well as comparisons significant for testing equality of variances and equality of means by "Levene and ANOVA tests respectively.

Table (3-10-5-3): Summary Statistics of HCI parameters concerning Muscle involved diagnosis for studied Headache disorder group

Parameters	Resp.	No.	Mean	S.D.	S.E.	Levene's Test for Equality of Variances		t-test for Equality of Means		
						F-value	Sig.	t-value	df	Sig. (2-tailed)
HCI at 3 - right	M.I. (T)	16	45.0	7.08	1.77	2.45	0.135 NS	1.029	18	0.317 NS
	M.I (M+T)	4	40.0	14.24	7.12					
HCI at 5 - right	M.I. (T)	16	41.94	8.86	2.21	1.248	0.279 NS	0.566	18	0.578 NS
	M.I (M+T)	4	38.75	14.68	7.34					
HCI at 3 - left	M.I. (T)	16	44.5	9.89	2.47	0.066	0.801 NS	1.009	18	0.326 NS
	M.I (M+T)	4	39	9.02	4.51					
HCI at 5 - left	M.I. (T)	16	41.31	9.58	2.39	0.285	0.600 NS	0.934	18	0.363 NS
	M.I (M+T)	4	36.5	7.14	3.57					

With respect to testing equality of variances, and equality of mean values, results showed that no significant differences are accounted at P>0.05 among Muscle involved diagnoses either for variances or for mean values at P>0.05 concerning Headache disorder group.

Figure (3-10-5-3) represents graphically plotting bar charts of the mean values of HCI parameters concerning Muscle involved diagnosis for studied Headache disorder group.

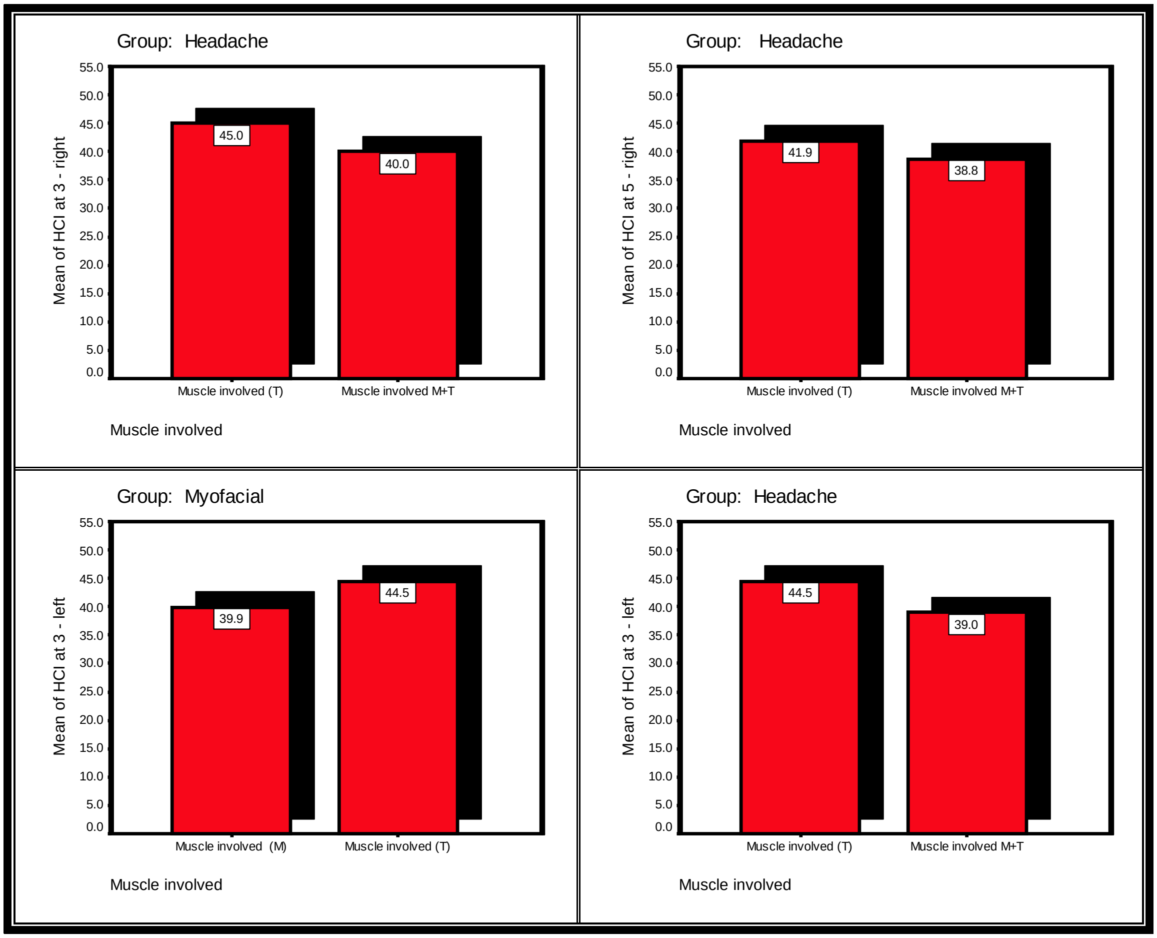


Figure (3-10-5-3): Bar charts plot of mean values of HCI parameters concerning Muscle involved diagnoses for studied Headache disorder group

Table (3-10-5-4) shows a summary statistics in different (TCI) parameters concerning Headache disorder group, in light of Muscle involved diagnoses (M.I. (T), and M.I (M+T)) such that, mean values, standard deviation, standard error, as well as comparisons significant for testing equality of variances and equality of means by "Levene and ANOVA tests respectively.

Table (3-10-5-4): Summary Statistics of TCI parameters concerning Muscle involved diagnosis for studied Headache disorder group

Parameters	Resp.	No.	Mean	S.D.	S.E.	Levene's Test for Equality of Variances		t-test for Equality of Means		
						F-value	Sig.	t-value	df	Sig. (2-tailed)
TCI at 3 - right	M.I. (T)	16	7.63	3.48	0.87	1.953	0.179 NS	0.737	18	0.471 NS
	M.I (M+T)	4	6.25	2.50	1.25					
TCI at 5 - right	M.I. (T)	16	7.50	3.61	0.9	7.468	0.014 S	2.766	15	0.014 S
	M.I (M+T)	4	5.00	0.00	0.00					
TCI at 3 - left	M.I. (T)	16	6.13	1.89	0.47	1.157	0.296 NS	1.606	18	0.126 NS
	M.I (M+T)	4	4.25	2.87	1.44					
TCI at 3 - left	M.I. (T)	16	6.13	1.59	0.4	1.691	0.210 NS	2.086	18	0.051 NS
	M.I (M+T)	4	4.00	2.71	1.35					

(*) **NS: No Sig. at P>0.05; Testing based on Levene, and Student t-tests.**

With respect to testing equality of variances, and equality of mean values, results showed that no significant differences are accounted at P>0.05 among Muscle involved diagnoses either for variances or for mean values at P>0.05 concerning Headache disorder group.

Figure (3-10-5-4) represents graphically plotting bar charts of the mean values of TCI parameters concerning Muscle involved diagnoses for Headache disorder group.

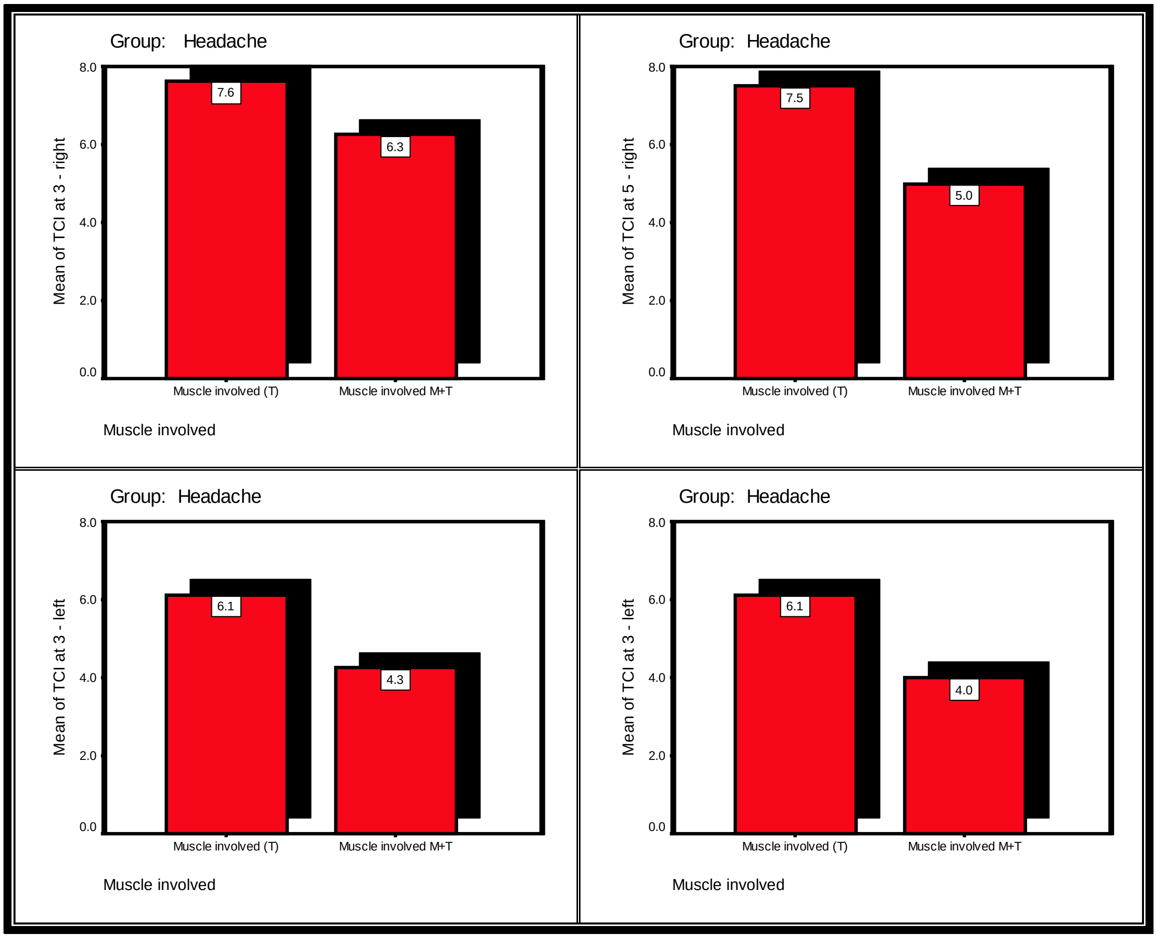


Figure (3-10-5-4): Bar charts plot of mean values of TCI parameters concerning Muscle involved diagnoses for studied Headache disorder group

Table (3-10-5-5) shows a summary statistics in different (HCI) parameters in Myofascial disorder group, concerning Supplemental muscle (Not Present, and Present) such that, mean values, standard deviation, standard error, as well as comparisons significant for testing equality of variances and equality of means by "Levene and ANOVA tests respectively.

Table (3-10-5-5): Summary Statistics of HCI parameters concerning Supplemental muscle (Not Present, and Present) for studied Myofascial disorder group

Parameters	Resp.	No.	Mean	S.D.	S.E.	Levene's Test for Equality of Variances		t-test for Equality of Means		
						F-value	Sig.	t-value	df	Sig. (2-tailed)
HCI at 3 - right	Not Present	12	43.58	10.59	3.06	0.06	0.810 NS	0.388	18	0.703 NS
	Present	8	41.63	11.77	4.16					
HCI at 3 - Left	Not Present	12	40.58	8.16	2.36	0.042	0.840 NS	-0.183	18	0.856 NS
	Present	8	41.25	7.63	2.70					
HCI at 5 - right	Not Present	12	41.50	10.99	3.17	0.143	0.710 NS	0.389	18	0.702 NS
	Present	8	39.50	11.66	4.12					
HCI at 5- Left	Not Present	12	39.58	7.75	2.24	0.004	0.948 NS	0.625	18	0.540 NS
	Present	8	37.38	7.73	2.73					

With respect to testing equality of variances, and equality of mean values, results showed that no significant differences are accounted at P>0.05 among Supplemental muscle (Not Present, and Present) either for variances or for mean values at P>0.05 in Myofascial disorder group.

Figure (3-10-5-5) represents graphically plotting bar charts of the mean values of HCI parameters concerning Supplemental muscle (Not Present, and Present) for studied Myofascial disorder group.

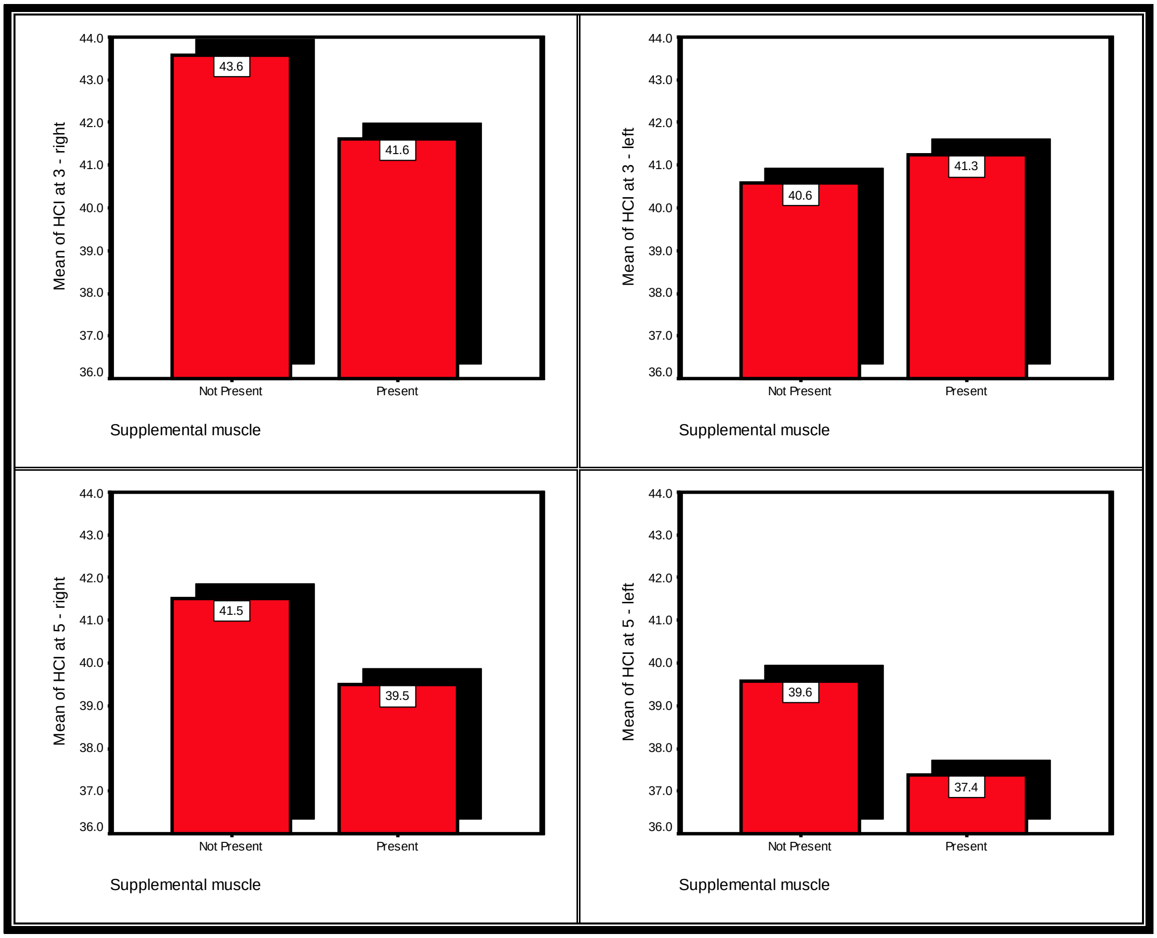


Figure (3-10-5-5): Bar charts plot of mean values of HCI parameters concerning Supplemental muscle (Not Present, and Present) for studied Myofascial disorder group

Table (3-10-5-6) shows a summary statistics in different (TCI) parameters in Myofascial disorder group, concerning Supplemental muscle (Not Present, and Present) such that, mean values, standard deviation, standard error, as well as comparisons significant for testing equality of variances and equality of means by "Levene and ANOVA tests respectively.

Table (3-10-5-6): Summary Statistics of TCI parameters concerning Supplemental muscle (Not Present, and Present) for studied Myofascial disorder group

Parameters	Resp.	No.	Mean	S.D.	S.E.	Levene's Test for Equality of Variances		t-test for Equality of Means		
						F-value	Sig.	t-value	df	Sig. (2-tailed)
TCI at 3 - right	Not Present	12	6.50	1.57	0.45	0.034	0.856 NS	0.356	18	0.726 NS
	Present	8	6.25	1.49	0.53					
TCI at 3 - Left	Not Present	12	6.42	2.61	0.75	0.424	0.523 NS	1.106	18	0.283 NS
	Present	8	5.13	2.47	0.88					
TCI at 5 - right	Not Present	12	6.67	2.02	0.58	0.07	0.794 NS	0.499	18	0.624 NS
	Present	8	6.35	1.49	0.53					
TCI at 5- Left	Not Present	12	6.50	2.71	0.78	1.611	0.221 NS	1.67	18	0.112 NS
	Present	8	4.63	2.00	0.71					

With respect to testing equality of variances, and equality of mean values, results showed that no significant differences are accounted at P>0.05 among Supplemental muscle (Not Present, and Present) either for variances or for mean values at P>0.05 in Myofascial disorder group.

Figure (3-10-5-6) represents graphically plotting bar charts of the mean values of HCI parameters concerning Supplemental muscle (Not Present, and Present) for studied Myofascial disorder group.

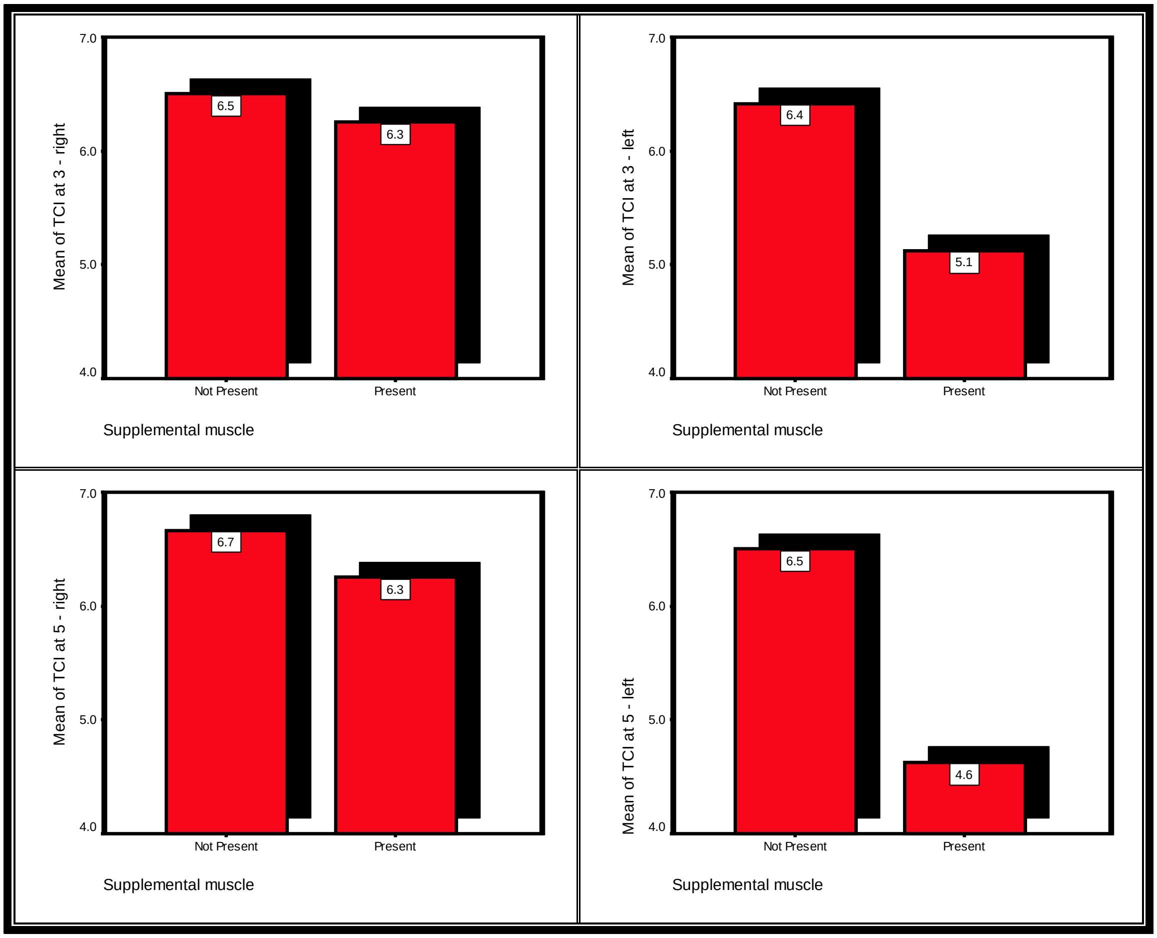


Figure (3-10-5-6): Bar charts plot of mean values of TCI parameters concerning Supplemental muscle (Not Present, and Present) for studied Myofascial disorder group

Table (3-10-6-1) shows a summary statistics of different (HCI) parameters in disorder groups, and controlled such that, mean values, standard deviation, standard error, as well as comparisons significant for testing equality of variances and equality of means by "Levene and ANOVA tests respectively.

Table (3-10-6-1): Summary Statistics of HCI parameters concerning disorder groups, and controlled

Parameters	Resp.	No.	Mean	S.D.	S.E.	Levene's Test for Equality of Variances		t-test for Equality of Means		
						F-value	Sig.	t-value	df	Sig. (2-tailed)
HCI at 3 - right	Disorders	100	43.70	9.01	0.90	0.474	0.493 NS	-2.448	118	0.016 S
	Control	20	49.25	10.44	2.33					
HCI at 5 - right	Disorders	100	42.02	9.00	0.90	0.21	0.647 NS	-2.973	118	0.004 HS
	Control	20	48.65	9.64	2.15					
HCI at 3 - left	Disorders	100	42.27	8.86	0.89	0.007	0.931 NS	-2.642	118	0.009 HS
	Control	20	48.05	9.32	2.08					
HCI at 5 - left	Disorders	100	40.74	8.83	0.88	0.22	0.640 NS	-2.903	118	0.004 HS
	Control	20	47.00	8.63	1.93					

(*) HS: Highly Sig. at P<0.01; S: Sig. at P<0.05; NS: No Sig. at P>0.05;

With respect to testing equality of variances, results showed that no significant differences are accounted at P>0.05 between disorder groups and controlled , while for equality of mean values significant differences are obtained in at least at P<0.05, and indicating that HCI parameter recorded low responses in disordered groups than controlled either for different sites or angles.

Figure (3-10-6-1) represents graphically plotting bar charts of the mean values of HCI parameters concerning compact disorder groups, and controlled.

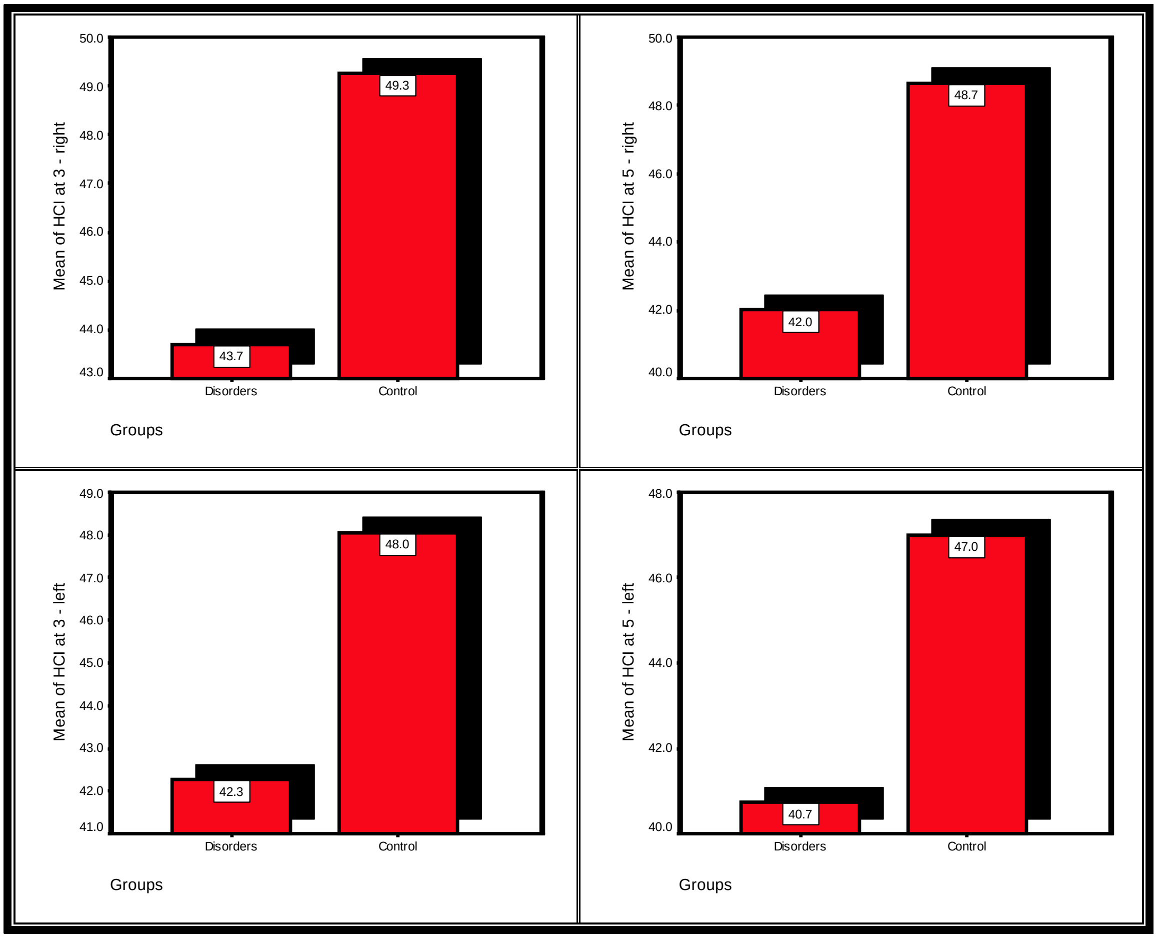


Figure (4-10-6-1): Bar charts plot of mean values of HCI parameter concerning compact disorder groups, and controlled

Table (3-10-7-1) shows a summary statistics of different (TCI) parameters in disorder groups, and controlled and such that, mean values, standard deviation, standard error, as well as comparisons significant for testing equality of variances and equality of means by "Levene and ANOVA tests respectively.

Table (3-10-7-1): Summary Statistics of TCI parameters concerning in disorder groups and controlled

Parameters	Resp.	No.	Mean	S.D.	S.E.	Levene's Test for Equality of Variances		t-test for Equality of Means		
						F-value	Sig.	t-value	df	Sig. (2-tailed)
TCI at 3 - right	Disorders	100	6.67	2.31	0.23	3.284	0.073 NS	-2.21	118	0.029 S
	Control	20	8.00	3.09	0.69					
TCI at 3 - Left	Disorders	100	6.35	2.13	0.21	0.361	0.549 NS	-1.707	118	0.090 NS
	Control	20	7.25	2.27	0.51					
TCI at 5 - right	Disorders	100	6.20	2.37	0.24	4.619	0.034 S	-2.664	118	0.009 HS
	Control	20	7.85	3.22	0.72					
TCI at 5- Left	Disorders	100	6.04	2.21	0.22	0.088	0.768 NS	-2.229	118	0.028 S
	Control	20	7.25	2.24	0.50					

With respect to testing equality of variances, results showed that no significant differences are accounted at P>0.05 between disorder groups and controlled , while for equality of mean values significant differences are obtained in at least at P<0.05, as well as TCI at 3 – left site which stating that simply significant was not achieved and that result should be informative, and for summarizing preceding results, it could be indicating that TCI parameter recorded low responses in disordered groups than controlled either for different sites or angles.

Figure (3-10-7-1) represents graphically plotting bar charts of the mean values of TCI parameters concerning compact disorder groups, and controlled.

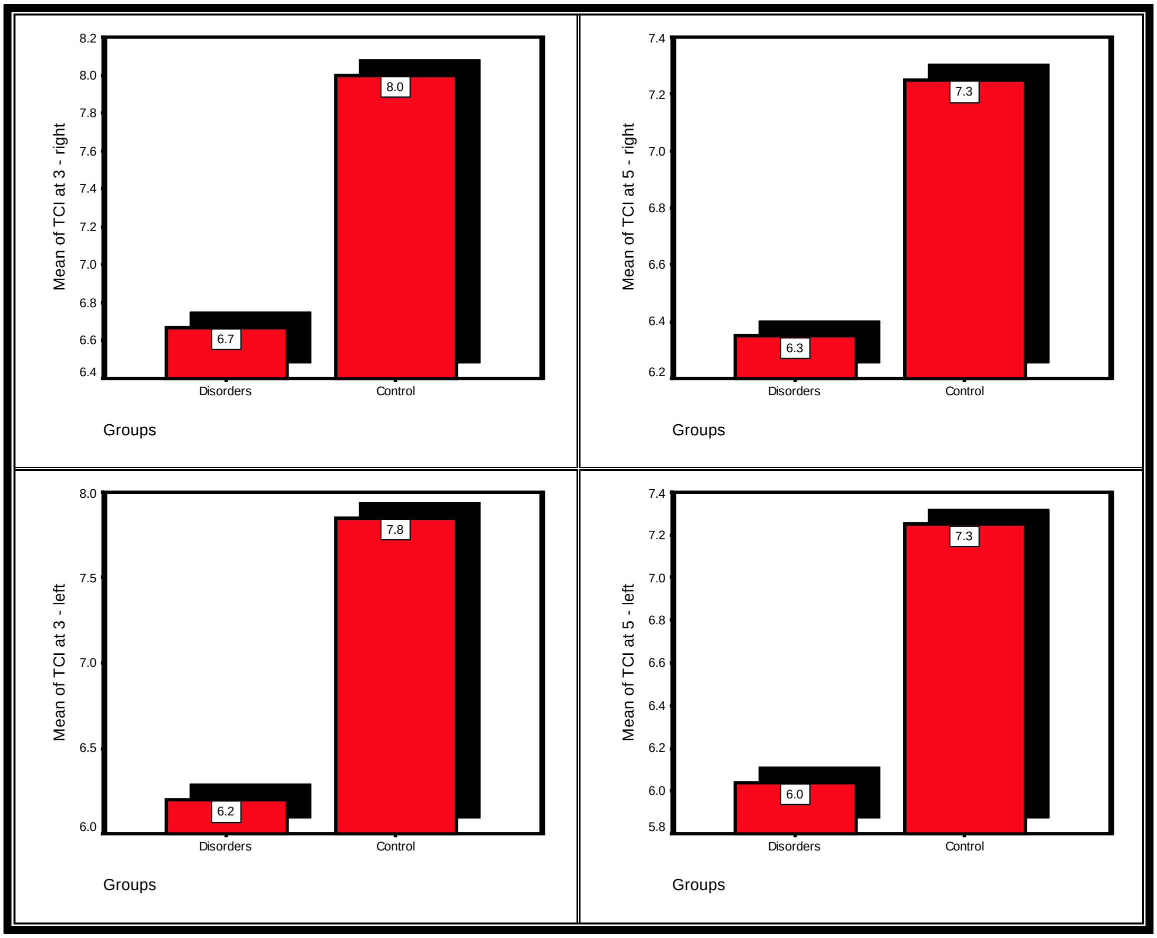


Figure (3-10-7-1): Bar charts plot of mean values of TCI parameter concerning compact disorder groups, and controlled

Discussion

The "Masticatory system" is a functional component of the body mainly responsible for mastication, swallowing, and speaking. The mandibular joint is an important part of this system and is composed of glenoid fossa, mandibular condyle and the articular disc. It is "a ginglimoarthrodial joint". Muscles of mastication play an important role in articulation of that joint (Jeffry P. Okenson, 2013).

The "Trempromandibular joint" is the most commonly used joint of the human body, and has concurrent bilateral capacity to move the mandible. Its components often undergo, remodeling and adaptation processes. In the presence of temporomandibular disorders (TMD), structural alterations and functional disorders frequently observed (Ferraz Júnior AML *et al*., 2012).

The most disturbing feature in TMD is pain, followed by limited mandibular movement, which can cause; difficulty eating or speaking, and noises from the mandibular joint (TMJ) during jaw movement. TMD can detriment quality of life, because the symptoms can become chronic, difficult to support and affecting professional performances. Their "etiology and pathogenesis" poorly understood, so control of TMJ diseases is difficult, and symptomatic treatment usually recommended (Andrea Maria Chisnoiu *et al*., 2016).

From the various epidemiologic studies on the occurrence of joint disorders in the general population, it is marked that there are a number of dependable findings. Firstly, signs of temporomandibular disorders appear in about; 60–70% of the general population and yet only about one in four people with signs are actually aware of or report any symptoms. The rate of "severe conditions" that accompanied by headache and facial pain and that are characterized by urgent need of treatment is 1–2% in children, about 5% in adolescents and 5–12% in adults (Graber, *et al.,* 2009).

Mandibular movements; occur as a complex series of interrelated three-dimensional rotation and translation activities. The two guiding factors that determine these mandibular movements, are the "condylar path" in the TMJ as the posterior controlling factors and the "anterior teeth" as, anterior controlling factors. The condylar pathway is peculiar to each individual patient (Okeson JP., 1993).

The "Locomotor system" of jaws, due to their complicated structure and function, sometimes require a wider range of diagnostic methods including those, which enable recording and visualizing individual mandibular movements. During the diagnostic process, jaw movement measurements combined with clinical examination of the masticatory system and the subjective description of pain can indicate the presence or absence of "temporomandibular disorders symptoms", as Patients with TMD frequently demonstrate changes in the mandibular movements (Anna Sójka *et al*., 2015).

Many studies attempted to utilize "condylar movement", as a mean of diagnosis of tempromandibular joint disorder by mechanical and electronic devices (Shields JM, *et al*., 1978, Mack H. 1979, Joaehim Theusner, Donald A. Curtis. 1993, Anna Sójka *et al*., 2015).

No reliable method, currently exists that can be absolutely used by researchers and clinicians, to diagnose and measure, the presence and severity of "temporomandibular disorders", therefore this study was conducted since no other study in Iraq has been conducted to use the electronic pantograph in diagnosis of tempromandibular joint disorders.

4.1 Demographical Characteristics

Results showed that Degenerative joint disease group had registered elder age among others disordered groups. Lawrence RC *et al*., 1998 point out that TMJ "degenerative joint disease" can occur at any age, although, it occurs with greater frequency as age increases. At 40 years of age, only 20 % of the population may have "degenerative change"; however, by 65 years, the rates drastically increase and a majority, will exhibit radiographic evidence of the disease.

The result of current study indicated that 56 female and 44 male made up the disordered group and 10 males and 10 females comprised the control group. The high prevalence of females among patients with TMD encountered in several studies (Truelove E.*et al*., 2006, Bergstrom I. *et al*., 2008 and Cairns BE 2010). Evidences suggest that this disorder is 1.5-2 times more prevalent in women than in men; 80% of patients treated for joint disorders are women (LeResche L., 1997). Female sex hormones, mainly estrogen, seem to play an important role in these in addition behavioral and psychosocial factors (Ribeiro-Dasilva MC. *et al*., 2009).

The "endogenous reproductive hormones", particularly estrogen might play a pathophysiological role in TMD comparable to many pain conditions such as migraine headache occurring mainly in women. Patil, *et al*., 2015 have found that increased "serum estrogen level" in women with mandibular joint disorder, and established a statistically significant relation between the (estrogen levels) of mild, moderate, and severe cases of TMDs as the hormone enhances inflammatory responses in the TMJ, through interaction with various mediators of inflammation, such as histamine, serotonin, substance P, platelet-activating factor.

4.2 Diseased Group's Duration

Result has indicated a significant difference concerning duration's periods distribution, which showed that most of disordered groups had registered a similarly durations, except Arthralgia group, and then followed by Intraarticular group, which had reported short duration periods compared with others disordered groups.

While up to twenty five percentage, of the population might experience symptoms of mandibular joint disorder, only a small percentage of afflicted individuals seek treatment especially, those had pain associated with TMD predominantly the "muscular and arthralgic pain" (Meghan K. Murphy *et al*., 2013), explain short duration for Arthralgia patients since myofascial pain was easily treated.

The symptom of arthralgia (joint pain) was the most common symptom that causes the patients to seek diagnosis and treatment (Tomislav Badel *et al*., 2016). While for intraarticular disorder, the prevalence of disc displacement was about 41% among TMD patients, it is clear therefore; that short duration of those disorders of patients seeking treatment (Marta MiernikA–D and Włodzimierz Więckiewicz 2015).

Regarding "Duration", result showed that weak relationship had reported concerning gender distribution in studied disordered groups. Although females generally had longer duration of TMJ symptoms. Velly *et al*., in 2003 reported that females had approximately, three times the risk of "tempromandibular pain" in contrast to males on groups of patients, and Females exhibited much more frequent TMD signs and symptoms compared to males in the studied population (Bagis, Bora. *et al*., 2012).

Numerous authors had reported a higher prevalence of "parafunctional habits" in females. The reason for female predominance could be credited to mental factors; these may include the stress and physiological changes (Ruela ACC, *et al*., 2001 and Manfredini D *et al*., 2004).The predominance of etiological factors in female might contribute to the findings, that female expected to have longer duration of symptoms.

4.3 Distribution of Pain

The "Temproporomandibular joint", innervated predominantly by the auriculotemporal, temporal and masseter nerves (Harris and Griffin 1975). Proprioception arises through four categories of receptors (Zimny, 1988): the "Ruffini mechanoreceptors" type I, the "pacinian corpuscles" type II, the "Golgi tendon organs" type III, and the free "nerve endings" type IV. These receptors situated in the joint capsule, the lateral ligament, and in the bilaminar zone and its "genu vasculosum" (Thilander 1961).

Myofascial and Headache attributed to TMD groups had recorded one quarter and third percent at the sever level of pain respectively. The "Myofascial pain" was a significant health problem affecting, as much as 85% of the general population sometime in their lifetime (LeResche L., 1997).

The health impact of "myofascial pain" could be quite severe, since the patients with the disorder not only suffer from decreased functional status associated with musculoskeletal pain and loss of function, but also suffer from "impaired mood" as well as, "reduced quality of life" (M. Saleet Jafri, 2014).

The study M.T. John *et al.,* 2015 point out that tempromandibular joint disc disorders have the minimal impact on patients' reported "pain and disability".

The pain in degenerative joint disease usually mild in the morning, and May gets worsen depend on amount of daily activity (S. B.Milan, 2006).

Regarding "Pain", result showed that weak relationship had reported concerning age groups distribution and generally low number of elderly patients with severe pain quality.

Age differences in "pain perception" were inconsistent. Some studies indicate that older adults are more sensitive to experimental pain than young adults, whereas others suggest a decrease in sensitivity with aging (Lautenbacher S *et al.*, 2005 and - Rittger H et al., 2005).

That said, it was well documented that "sensitivity in sensory systems", decreases with advancing age for hearing, taste, smell, vision and touch due to in part to diminished numbers of specialized peripheral receptors, combined with a deterioration of the "supporting tissues" (Hof, PR. and Mobbs, CV 2001).

The core findings from studies on pain that had been carried out in humans comprise "an increased threshold and decreased tolerance" with the advancing age (Gibson SJ, Helme RD, 2001 and Gagliese L., 2009).

Pain is usually under-valued undertreated in older adults compared to the younger adults (Horgas AL *et al*., 2004). One contributor to this problem is that the "healthcare providers" often do not routinely screen for pain in elderly patients. In fact, one study established that only 40% of "elderly patients" screened for pain conditions (Chodosh J, *et al*., 2004).

The result of this study regarding pain showed that weak relationship had reported concerning gender distribution along studied disordered groups. In addition to that, female were illustrated a sever quality of pain more than male along all of the studied groups.

The "perception of pain" was an important component of pain assessment and treatment. Clinical and experimental research, indicates that pain is perceived, assessed, and treated differently depending on a person's sex, race/ethnicity, and age. Comparing to men, women report more pain and have "inferior pain threshold and tolerance" to the experimental pain stimuli (Riley JL., *et al*., 1998, Wise EA, *et al*., 2002 and Robinson ME, *et al*., 2005).

Comprehensive epidemiological studies across multiple geographic regions find that pain reported more frequently by women than by men (Fillingim RB, *et al*., 2009). Gerdle and colleagues in 2008 found that for each of 10 different anatomical regions, a greater proportion of women than men reported pain, and women were significantly more likely to report chronic widespread pain.

Sociocultural beliefs about "femininity and masculinity" also appear to be an important determinant of pain responses among the sexes, as pain expression was generally more socially acceptable among women, a result which might lead to biased reporting of pain. In a study by Robinson and colleagues, both men and women believed that men are less willing to report pain than woman, and such "gender role expectations" might contribute to sex differences in experimental pain (Robinson ME, *et al*., 2001).

4.4 Opening Pattern

The "Deviation during opening" either due to muscle or joint disorders. The deflection with intraarticular origin, differentiated from the deflection with muscular one by observing the protrusive movement. On the protrusion, if the mandible deflected to the side of the involved joint this condition recorded as intraarticular deflection, while with muscular origin the deflection will not observed in protrusive movement. (Sevgi Senera and Faruk Akgunlua, 2011).

Result demonstrate distribution of disordered sample according to opening patterns (corrected and straight), in which Degenerative joint disease group had the vast majority within correct opening pattern.

The Deviation in opening, in "a bayonetlike projection" was an important sign of the disc displacement, but if the extent of opening was not restricted, the disorder is not permanent (Olivier LAPLANCHE *et al*., 2012).

Deviation in patients with degenerative joint disease on opening to the affected side (Keith A. Yount, 2011). When condylar resorption occurs unilaterally, the mandibular typically shift to the affected side. Result was "anterior open bite" linked with "posterior open bite" on the contralateral side, with the occlusal contact occurring only on the posterior district of the affected side (Waleska C. *et al*., 2016).

Goto *et al*., (2005) also investigated the correlation between a mandibular midline deviation and "trempromandibular joint disorder". They reported that, the TMJ condyle on the side of the midline shift showed a slighter size compared to other in patients with degenerative joint disease, which explain high percentage of patients with deviation in degenerative joint disease in this study.

However the higher percentage of deviation in elder population may be indicative of disk displacement, (Teixeira MJ and Siqueira JTT. 2012), and it may also result from anatomical changes such as condylar hypoplasia, joint inflammation, absence of the occlusal guides and imbalance of the masticatory muscle (Figueiredo VMG *et al*., 2009 and Chiodelli L, *et al*., 2012).

4.5 Muscles of mastication involved

The present study showed the most common muscle involved in myofascial-disordered group were masseter followed by temporalis, Research records indicate that palpation assessment to the "masseter and temporalis muscles" were the most reliable, and, (more importantly), data from the Validation Project, demonstrate that these two muscles bilaterally were satisfactory for the diagnosis yield 99% of the time. Even though, the false negative rate by only using these muscles bilaterally was therefore around 1%, in clinical settings it may be useful to include the less reliable masticatory muscles for palpation, in order to provide a complete examination relative to the patient's complaint (Ohrbach R, *et al*., 2013).

Yair Sharav and Rafael Benoliel in 2008 had drawn attention to the fact that, "masseter muscle" in masticatory muscle pain was the most involved among other muscles with more than 60% of involvement, Masseter was the major muscle affected in myofascial-disordered group.

Headache attributed to "tempromandibular joint disorder" patients had muscle pain in the temporalis and masseter region or both area, many studies have shown an association between the masticatory myofascial pain MMP and headache (Benoliel R, Birman *et al*., 2008, Benoliel R, *et al*., 2011, Gonçalves DA, *et al*., 2011).

Recently, the diagnostic criteria for the temporomandibular disorders (DC/TMD) incorporated a new classification, "headache attributed to TMD" (HATMD) (Ohrbach R, *et al*., 2013), which proposed that the myalgia and the temporomandibular joint arthralgia, are associated with headache.

In contrast, the "International Classification of the Headache Disorders", the Third Edition beta (ICHD-3 beta) defines headache and facial pain due to problems in the TMJ, masticatory muscles, and/or associated structures as (secondary headache). Confirmation of the "myofascial trigger point" MTrP., where palpation evokes the familiar pain, suggests that headache originates from the MTrP and that myofascial pain, did not initiated from the intracranial structures (Kazuhiko Hara *et al*., 2016).

The "Supplemental muscles presence" in Myofascial disorders group, were evaluated, results showed no significant difference in distribution of supplemental muscle although the "lateral pterygoid muscle" involved more than other muscles which agree with Pramod john R., in 2014 who made clear that the "lateral pterygoid muscle" was one of the most frequently involved muscle in myofascial pain dysfunction syndrome.

The result in this study showed Distribution of the studied sample's disorder Myofascial according to (Area Involved) of both masseter and temporalis, in which Masseter muscle had the vast majority involvement within middle and superior areas and Temporalis responding within middle anterior area.

Mirian Nagae *et al*., in 2011 point out in his study that the anterior and middle portions of the Temporalis muscle have a major part of sustaining movement during temporalis muscle function explaining involvement of middle anterior area of the muscle in this study.

6.4 Distribution of mouth openings Parameters

Muscle and TMJ disorders are often the causes of "limited mandibular movements". Some studies had pointed out that significant difference in mandibular movement, between asymptomatic subjects and patients with TMD (Capurso U. 1996 and Miller VJ, *et al*., 1999).

One of the most significant signs and symptoms of TMD according to the (American Dental Association) was restriction in the mandibular range of motion. "Limited movement" considered as a sign of dysfunction, so measurement and assessment of mandibular movement ranges is an important factor within the clinical examination and a significant component, in the treatment and follow up of the "temporomandibular joint disorders" (Vassil Svechtarov, *et al*., 2016).

Khalid H. Zawawi, *et al*., 2003 stressed that "Maximum mouth opening" varies prominently from one subject to another and henceforward, the measurement of MMO on its own could be misleading, making it difficult to set a criteria for impairment of mandibular movement. Ingervall's findings in 1971 suggest that the "maximum mandibular opening" differs depending on the length of the mandible, the length of the anterior cranial base and the ramus inclination.

Regarding to "Maximum Mouth Opening", the result of this study illustrated that degenerative joint disease, and Myofascial groups had recorded low mean value, then followed by Headache, and Arthralgia, groups, while high levels are recorded by Intraarticular group, even though high values were recorded within controlled group with significant relation established between disordered groups and control.

While On the subject "Assisted Mouth Opening", degenerative joint disease, and Myofascial groups had recorded too low mean value, then followed by Headache group, while high levels are recorded by Intraarticular, and Arthralgia groups, even though high value were recorded within controlled group with significant relation settled between disordered groups and control.

Both Maximum Mouth Opening and Assisted Mouth Opening measurements showed lower most mean values for degenerative joint disease, and Myofascial Group.

It had been observed that diseased TMJ disorder in general leads to altered; mostly reduced mandibular movement ranges (Bodner L and Miller VJ, 1998).

Abhijeet Deoghare and Shirish Degwekar in their study in 2010 point out that decreased mouth opening was found in (86.66%) of patients with "osteoarthritis" and was one of the most common findings along with crepitation and might related to the mechanical impediment of articular surface that limit condylar translation.

Blečić *et al*., 2005 stated that "myofascial pain" had a huge influence on mandibular mobility. They observed a significant difference between patients with myofascial pain of the masticatory muscles and healthy controls in relation to maximal unassisted opening, assisted opening.

David G. Simons *et al*., in 1999 point out that the active range of motion might reduce with "masticatory muscles active Trigger point" although the decreased in range of movement might due to primarily to the inhibition by pain.

4.7 Distribution of excursive movement Parameters

Results of the study stated that Mediotrusion-Right, Myofascial group had recorded too low mean value, then followed by degenerative joint disease, and Headache groups, followed by Arthralgia, and Intraarticular, and high values were recorded within controlled group.

On other hand Mediotrusion-Left, Myofascial group had recorded too low mean value, then followed by Osteoarthritis, Headache, and Arthralgia groups, followed by Intraarticular, and high values were recorded within controlled group.

The Lateral movements of less than 8 mm generally classified as restricted [some authors set the cut-off point to 7 mm], the mean values for lateral movement of control patients in this study were within the range of normal.

The studies by Celic *et al*., in 2003 and 2004 clarified that the statistically significant differences in the range of lateral mandibular movements clearly separated asymptomatic subjects and patients with muscle and TMJ disorders.

According to Jeffry P. Okenson in 2013, evidence suggested that the muscle pain straightly related to the functional activity of the muscles involved. Therefore, the patients often stated that the pain usually influence their functional activity.

Regarding to "Protrusion", the results showed that Myofascial group had recorded too low mean value, followed by degenerative joint disease, and Intraarticular groups, followed by Arthralgia, and Headache, even though vast majority recorded within controlled group.

The "Protrusive movements" of less than 7 mm were considered restricted, although they were not always a signs of pathology that urgently calls for managment (Vassil Svechtarov *et al*., 2016).

There were significant differences in length and form of protrusive movements of left and right joints between asymptomatic subjects and patients with TMD (Piehslinger *et al*., 1994).

A Significant difference in protrusion observed between control group and myofascial disorder group in agreement with (Blečić N *et al*., 2005.)

Restricted protrusion that causes pain is usually from the inferior head of the painful side lateral pterygoid (Betsy Mitchel *et al*., 2015).

The contraction of the superior part of masseter, which runs diagonally to the front, moves the mandible forward (protrusion) along with anterior fiber of temporalis (David G. Simons et al., in 1999), the involvement of masseter, temporalis and lateral pterygoid in most of myofascial disorder group might explain reduction in protrusive movement measurement.

4. 8 Distribution of intraarticular disc disorder types

Patients with intraarticular disorder subdivided into intraarticular disc disorder with reduction 85% and intraarticular disc disorder with reduction with intermittent locking 15%, patients with intraarticular disc disorder without reduction with limited mouth opening and patients with intraarticular disc disorder without reduction with normal opening were not encountered in this study.

The result was consistent with Marta Miernik and Włodzimierz Więckiewicz in 2015 who stated that the most common form of intraarticular disc disorders was "disc displacement with reduction" characterized by the clicking in the temporomandibular joint. Furthermore, about 5% of intraarticular disc disorders cases, the disc displacement without reduction observed.

4.9 Image findings

Magnetic resonance image finding showed that 60% percentage of patients had anterior disc displacement; other patients had normal disc position, this result being in close proximity with study of Mahrokh Imanimoghaddam *et* *al*., 2013 they found that "Normal disk position", described in 51.9% of cases whereas disk displacement was found in the 42.3% of patients.

This can be accounted as similarity between a symptomatic hypermobility manifest as clicking and reciprocal click in patients with disc displacement with reduction (Naeije M, *et al*., 2009).

Other authors [Isberg-Holm AM, Westesson PL 1982 and Westesson PL*et al*., 1989] also describe the clicking sound in the joints with a normal disc position in which the clicking seemed to occur in link with the "jump by the disc and condyle over the eminence". Other possible explanations include deviations in condylar form (remodeling), the muscular incoordination, and adhesions [Schiffman E, *et al*., 1989].

In a study of Lamia Al – Nakib in 2007, it was found that 13(38.23%) patients, which clinically diagnosed to have internal derangement, showed normal condoyle disk relationship in MRI. The reason for the false positive diagnosis, the normal non-reducing joint may be audible during opening, closing and on lateral excursion, which suggests a possible reduction of "disk position" during clinical examination in addition "partial anterior displacement" were usually invisible on MRI.

The main characteristics of (disc displacement with reduction) are the joint clicking. Yet, such symptom should not be considered as "a pathognomonic factor" to DDWR, since it might result from other conditions, such as the hypermobility of condyle and disc, shape alterations, disc adhesions, and perforations (Lalue-Sanches M *et al*., 2005).

The result of CT image finding showed that 45% of patients showed flattening, 25% of patients showed space narrowing, 10% of patients showed osteophyte formation, 10% of patients showed subchondral thickening and 10% of patients showed erosion.

The diagnosis of patients with degenerative joint disease, according to Diagnostic Criteria for Temporomandibular Disorders 2013based on presence of crepitation which generated during joint movements, secondary to cartilage loss and the direct friction or rubbing against bone.

According to Abhijeet Deoghare and Shirish S Degwekar in 2010 in patients with degenerative joint disease, the most common finding was flattening (43.33%). While F. Massilla Mani a, and S. Satha Sivasubramanian in 2016 found that flattening (56.6%) and joint space narrowing (40%) were the most predominant finding in the study of "temporomandibular joint osteoarthritis" using computed tomographic imaging which was the most common finding in this study.

Marcella Quirino *et al*., 2016 point out that the most frequent degenerative bone changes in the condyle and articular eminence were flattening (58.5%) of patients. The reason behind that high prevalence of flattening detected in that sample may be explained by the possibility that such outcome could be an adaptive change, in addition to "a degenerative change" resulting from, an overload on the mandibular joint.

4.10 Horizontal condylar inclination and Transverse condylar inclination

Appropriately, elicited medical history and a comprehensive clinical investigation were the "foundation for any diagnosis" of disorders affecting the human body. Mandibular joints, due to their complicated structure and function, sometimes require "a broader range of diagnostic approaches" including those, enable assessing, determining and visualizing individual mandibular movements.

Many researchers accentuated the importance of "electronic axiography" in differential diagnostics of the mastication organ dysfunctions, due to accuracy and precision of the measurement data obtained (Celar and Tamaki, 2002 and Pr¨oschel et al., 2002), since it was a major part of instrumental analyses in clinical dental practices to evaluate "functional states of the stomatognathic system". The Condylar movements not only determined by the pathologies in the disc, articular eminence, and the ligaments of the joint but also by the occlusal and "neuromuscular factors" that impact the mandibular movement. (Anna Sójka *et al*., 2015).

Bernhardt O *et al*., in 2003demonstrated in clinical study; that the "cadiax compact system" provides sufficient reliability of the sagittal condylar and the transversal condylar inclination angles measurements. (Bernhardt O *et al*., 2003).

The angle at which the condyle moves away from the "horizontal reference plane" was referred to as the condylar guidance. That angle differs from person to person and from one side to the other (Okeson JP., 1993).

The normal value of the articular eminence angle in adults had reported to be 30º–60º. Articular eminences having inclination values less than 30º have been categorized as flat, and those having values larger than 60º have been categorized as steep (Katsavrias, 2002).

A study of fully dentate adult found "sagittal condylar inclination" angles to be between 40 and 49 degrees (Orth B.,2004), yet additional study stated values between 44 and 55 degrees (Alsawaf MM and Garlapo DA 2004), which were within the range measurements of control group in this study.

The Applied consequences, of setting the articulator's condylar guidance higher than the subject's relative angle could possibly result in restorations with the protrusive and lateral interferences (A Sowjanya Godavarthi *et al*., 2015).

Regarding to HCI right, degenerative joint disease group had recorded low mean value, then followed by Myofascial, group, while high levels recorded by Arthralgia, even though vast majority were recorded within controlled group.

With respect to HCI left, Osteoarthritis, and Myofascial groups had recorded low mean values, then followed by Intraarticular, and Arthralgia groups, while high levels recorded by Headache, even though vast majority were recorded within controlled group.

As the condyle moves out of the most superior position from glenoid fossa, it slides along the posterior slope of the articular eminence. The angle at which the condyle moves away from the "horizontal Frankfort plane" referred to as the condylar guidance angle. Hence, the articulating surface of the condylar head as well as the slope of the eminence would influences the "horizontal condylar inclination" obtained (Takayama Y, *et al*., 2008).

The flattening of the condylar head of mandible, local erosion, local bony outgrowth (osteophyte) and sclerosis of articular surface, as well as the decrease in the posterior slope of the articular eminence results in decreased downward movement of the condyle in the glenoid fossa relative to the "horizontal Frankfort plane" resulting in a decreased horizontal condylar angle explained the low value for degenerative joint disease (T. Sreelal *et al*., 2013).

The second low value of horizontal condylar inclination were myofascial and headache attributed to TMD groups, those two groups had second high mean age after degenerative joint disease which might be the cause for low value since T. Sreelal *et al*., in 2013 has drawn attention to the fact that, There is a significant difference in horizontal condylar angle in the different age groups and as the age increases the "horizontal condylar angle" decreases.

Since etiology of myofascial pain involve Occlusal disturbances, Emotional turmoil, and parafunctional habit; all have been associated with functional overloading in the TMJ, when excessive or sustained physical stress that exceeds the normal adaptive capacity of the TMJ articular structures; which might result in the physiological and degenerative changes of "condyle and articular eminence"; causing flattening of their surfaces decreasing the values of their horizontal condylar inclination (Israel, H.*et al*., 1999 and Pe´rez-Palomar, A. and Doblare´, M. 2006).

The patients with parafunction habits in the form of clenching demonstrated a significantly higher TMJ asymmetry than those with no disorders; it had been theorized that "dysfunction of fascial muscles" can lead to degenerative changes for condyle and articular eminence which also explain the low value of horizontal condylar inclination (Okeson, J. P, 1998 and Hiraba K.,et al., 2000).

C Nishio et al., 2009 concluded that the displacement of the disc could affect the pressure distribution on the condylar articular surface especially in the posterior area, possibly leading to cartilage collapse on the condylar articular surface. This result also shows that the "disc displacement" may be involved in the progression of TMJ degenerative joint disorders, given this evidence, it can be seen that the small value of horizontal condylar inclination compare to control can be explained.

Wafaa jabbar in 2017 demonstrated that there was a significant relation between flattening of articular surfaces and duration of internal derangement.

Arthralgia reported high value of horizontal condylar inclination; TMJ arthralgia characterized by joint tenderness and periauricular pain with occasional referral to the periauricular, upper neck, and temporal regions.

Arthralgia Pain linked to inflammatory and/or mechanical factors. If the inflammation was significantly present, the diagnosis involve capsulitis or synovitis. The inflammatory process might also be due systemic condition, including rheumatoid arthritis. Mechanical related pain might related with; disc displacement with reduction with intermittent locking, disc displacement without reduction with limited opening and degenerative joint disease (James R. Fricton and Eric L. Schiffman 2015).

Since patients with arthralgia in this study didn’t had clicking, crepitation or any sign of systemic diseases, the cause mainly inflammatory, which explain the high value of horizontal condylar inclination compared to other disorder.

The Flattening of condyle and articular eminence was "an adaptive physiological response" to the forces beyond the threshold of joint, which lead to deformation of the curved surfaces of the joint to flat surfaces. That change occurs in absence of destructive joint changes, so that it can overcome the extensive forces result from various disorder by spreading them over a broader surface

(Honda K. *et al*., 2008). Might explained reduced horizontal condylar angle value for disorder groups in contrast to control group in general.

The sagittal condylar inclination and Bennett angle comprise the condylar guidance settings on several articulators, and precise condylar guidance values can help increase the accuracy of prosthetic replacement (Hobo S, et al., 1976).

Errors in assessing the Bennett angle will affect the "groove and ridges" positions in the working and nonworking sides and, to a lesser magnitude, the cusp height (Boulos PJ, *et al*., 2008).

The average value of transverse condylar inclination, in this study for control group were between 7-8 degree which in agreement Samir Cimi *et al*., 2016 they found in their study, that the average value of the Bennett angle was 8 degrees, the values of the present study were nearly similar to those obtained in Theusner *et al*., 1993 (7.6 degrees)Canning *et al*., 2011 (8 degrees), , and Hernandez *et al*., 2010 (about 8 degrees).

The Bennett angles with different values obtained in other studies, might be attributed largely to a difference in investigation and technique procedures. For example, studies which used (the mandibular recording devices) showed "Bennett angle" values in the range of 7 to 8 degrees, which is similar to the results obtained in the present study,

Ma'an Zakaria in 2016 record "Bennett angle" values using the interocclusal records and Hanau H-2 non-arcon semi-adjustable articulator by mean of Hanau formulae which is considerably higher (15.54° & 15.39°) this result along with other studies used the interocclusal methods (Hernandez AI *et al*., 2010, Canning *et al*., 2011, Torabi K *et al*., 2014).

The results of this study revealed that the mean values "Bennett angle" of disordered groups is less than that of control group, yet the relations between each disordered groups and control were statistically non-significant, except for myofascial and headache groups in the left side (myofascial group showed the lowest mediotrusion values).

That result attributed In addition to the osseous morphology of the mandibular joint, mandibular movement that determined Bennett angle affected by articular disc, the degree of tension on the associated ligaments and the neuromuscular system (Clayton JA *et al*., 1971), all of which affected by tempromandibular disorder and explain to some degree the difference with control group.

Simonet PF and Clayton JA. In 1981 investigated Influence of TMJ dysfunction on Bennett movement as recorded by a modified pantograph and found that Post-treatment "Bennett movement registrations" indicated a statistically significant increase of the movement.

Joaehim Theusner and Donald A. Curtis illustrated in their study of the Axiograph tracings of temporomandibular joint movements in 1993 that "Bennett angle" was altered in the symptomatic tempromandibular joint disorder group, and significantly lower compared to asymptomatic group, {symptomatic group was 5.2 degrees (RJ) and 7.2 degrees (LJ)} which was the nearly the same outcome of this study, and claimed that the changes in osseous component shape of the joint could be the responsible for the results.

The results showed that no significant differences between IADD, and IADDIL group's variances of studied parameters, as well as no significant differences between IADD, and IADDIL throughout equal mean values of Horizontal condylar inclination and Bennett angle.

Since IADDIL is identical to disc displacement with reduction in all features and symptoms, with the additional feature of intermittent limited mandibular opening on the occasions that the disc does not reduce (Andrew L. Young, 2016), beside low number of patients which might explain the previous result.

The results showed that no significant differences are accounted at $P>0.05$ between two groups of MRI image finding for intraarticular disc disorder group which enhance the idea that partial anterior displacement are usually unnoticeable on MRI & this in harmony with Kertens *et al*, 1989.

H Kurita *et al*., in 2000 point out that fattening of the articular eminence occurs as a result, of remodeling or degenerative changes secondary to intraarticular disc disorder due to the imbalance in stress distribution that cause decrease value of horizontal condylar inclination.

The result of this study illustrated that no significant differences were among Image findings of CT scan for degenerative joint disease group for both Horizontal condylar inclination and Bennett angle.

This might explained by fact that the degenerative joint disease of TMJ usually affects both "mandibular condyle and articular eminence" resulting mostly in flattening and erosion reducing the value of horizontal condylar inclination and affected the bony contour of mandibular fossa impacting the value of bennett angle (R. D. Leeuw *et al*., 1995, K. Yamada, *et al*., 2004, S. B.Milan, 2006).

The results showed that no significant differences among Muscle involved concerning Myofascial disorder group for transvers condylar inclination which might explained in that both "masseter and temporalis muscles" both involve in lateral mandibular movement among other factors affect bennett movement (Pramod Join, 2014).

The results showed that no significant differences among Supplemental muscle (Not Present, and Present) in Myofascial disorder group for transverse condylar inclination this might attributed to the involvement of many muscles in lateral movement of condyle as well as lateral, sphenomandibular and stylomandibular ligaments (Axel Bumann and Ulrich Lotzmann, 2002) which limit such movement all affect the magnitude of bennett movement.

The assessment of the masticatory system movement cannot be done using the "mechanical devices" alone, but should also be accompanied by detailed clinical and imaging assesment, contributing together for better evaluation of tempromandibular joint disorder (Anna Sójka *et al*., 2016).

Conclusions

1- Patients with tempromandibular joint disorder had restricted mouth opening in comparison to control group.
2- Protrusive and mediotrusion values for patients with tempromandibular joint disorder significantly lower than control groups
3- Horizontal condylar inclination values for degenerative joint disease, arthralgia, myofascial, headache attributed to TMJ and intraarticular disc disorder patients significantly lower than control group therefore this parameter could be use in diagnosis of joint disorder.
4- Bennett angle mean value for degenerative joint disease, arthralgia, myofascial, headache attributed to TMJ and intraarticular disc disorder patients lower than control group and statistically significantly in left joints in myofascial and headache group and might use as preliminary detector.
5- No significant relation had been established between MRI findings related to disc displacement for intraarticular disc disorder group regarding Horizontal condylar inclination and Bennett angle.
6- No significant relation had been established between CT image findings related to osteogenic articular surface changes for degenerative joint disease disorder group regarding Horizontal condylar inclination and Bennett angle.
7- Axiographic tracings of the mandibular movements present additional significant information and its benefit lies in its noninvasive recordings of condylar path, which completes patient's dental history and clinical examination, and with electronic axiography, all the data could be documented on the computer, which enables future comparison, monitoring and treatment of the TMDs.

Suggestions

1- Measurement of horizontal condylar inclination and Bennett angle for larger no. of tempromandibular joint patients with matching age groups.

2- Determine the change in Bennett angle value before and after treatment for tempromandibular joint patients.

3- Measurement of immediate side shift value for tempromandibular joint patients and compare to control group.

4- Measurement of horizontal condylar inclination and Bennett angle for larger no of patients with malocclusion and compare to control group.

5- Determine the tempromandibular joints condition of patients with fixed and removable appliance fabricated on articulator without taking in account the value of Horizontal condylar inclination and Bennett angle.

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Appendix 1

موافقة للاشتراك في البحث العلمي

أسم الباحث:

عنوان البحث:

مكان اجراء البحث:

أنت مدعو(ة) للمشاركة ببحث علمي سريري سيجرى في _ _ _ _ _ _ _ _ _ _ _ _ _ _

الرجاء ان تأخذ(ي) الوقت الكافي لقراءة المعلومات التالية بتأن قبل ات تقرر(ي) اذا كنت تريد(ين) المشاركة أم لا. بامكانك طلب ايضاحات او معلومات اضافية عن أي شئ مذكور في هذه الاستمارة أو عن هذه الدراسة ككل من طبيبك.

في حال وافقت على المشاركة في هذه الدراسة ، سيبقى اسمك طي الكتمان.

لن يكون لأي شخص ، ما لم ينص القانون على ذلك ، حق ألأطلاع على ملفك الطبي باستثناء الطبيب المسؤول عن الدراسة ومعاونيه.

موافقة المشترك:

لقد قرأت استمارة القبول هذه وفهمت مضمونها. تمت الاجابة على اسئلتي جميعها . وبناء عليه فأنني، حرا مختارا ، أجيز إجراء هذا البحث وأوافق على الإشتراك فيه ، وإنني اعلم أن الباحث الدكتور ____________________ وزملاءه ومعاونيه او مساعديه سيكونون مستعدين للإجابة على أسئلتي وأنه باستطاعتي الإتصال بهم على الهاتف____________

واذا شعرت لاحقا ان الأجوبة تحتاج إلى مزيد من الإيضاح فسوف أتصل بأحد اعضاء لجنة الاخلاقيات. كما أعرف تمام المعرفة بانني حر في ألإنسحاب من هذا البحث متى شئت حتى بعد التوقيع على الموافقة دون ان يؤثر ذلك على العناية الطبية المقدمة لي.

اسم المشترك:

توقيع المشترك:

Appendix 2

The Examination Form of Diagnostic Criteria for Temporomandibular Disorders

9.2 International (FDI) Format

DC/TMD Examination Form

Patient ____________________ Examiner ____________________

Date filled out (mm-dd-yyyy) [ ][ ]-[ ][ ]-[ ][ ][ ][ ]

1a. Location of Pain: Last 30 days (Select all that apply)

RIGHT PAIN	LEFT PAIN
O None O Temporalis O Masseter O Other m muscles O TMJ O Non-mast structures	O None O Temporalis O Masseter O Other m muscles O TMJ O Non-mast structures

1b. Location of Headache: Last 30 days (Select all that apply)

Right	Left
O None O Temporal O Other	O None O Temporal O Other

2. Incisal Relationships Reference tooth O FDI #11 O FDI #21 O Other

Horizontal Incisal Overjet O If negative [ ][ ] mm   Vertical Incisal Overlap O If negative [ ][ ] mm   Midline Deviation Right O Left O N/A O [ ][ ] mm

3. Opening Pattern (Supplemental; Select all that apply) O Straight O Corrected deviation   Uncorrected Deviation O Right O Left

4. Opening Movements

A. Pain Free Opening [ ][ ] mm

		RIGHT SIDE Pain	Familiar Pain	Familiar Headache	LEFT SIDE	Pain	Familiar Pain	Familiar Headache
B. Maximum Unassisted Opening [ ][ ] mm	Temporalis	Ⓝ Ⓨ	Ⓝ Ⓨ	Ⓝ Ⓨ	Temporalis	Ⓝ Ⓨ	Ⓝ Ⓨ	Ⓝ Ⓨ
	Masseter	Ⓝ Ⓨ	Ⓝ Ⓨ		Masseter	Ⓝ Ⓨ	Ⓝ Ⓨ	
	TMJ	Ⓝ Ⓨ	Ⓝ Ⓨ		TMJ	Ⓝ Ⓨ	Ⓝ Ⓨ	
	Other M Musc	Ⓝ Ⓨ	Ⓝ Ⓨ		Other M Musc	Ⓝ Ⓨ	Ⓝ Ⓨ	
	Non-mast	Ⓝ Ⓨ	Ⓝ Ⓨ		Non-mast	Ⓝ Ⓨ	Ⓝ Ⓨ	
C. Maximum Assisted Opening [ ][ ] mm	Temporalis	Ⓝ Ⓨ	Ⓝ Ⓨ	Ⓝ Ⓨ	Temporalis	Ⓝ Ⓨ	Ⓝ Ⓨ	Ⓝ Ⓨ
	Masseter	Ⓝ Ⓨ	Ⓝ Ⓨ		Masseter	Ⓝ Ⓨ	Ⓝ Ⓨ	
	TMJ	Ⓝ Ⓨ	Ⓝ Ⓨ		TMJ	Ⓝ Ⓨ	Ⓝ Ⓨ	
	Other M Musc	Ⓝ Ⓨ	Ⓝ Ⓨ		Other M Musc	Ⓝ Ⓨ	Ⓝ Ⓨ	
D. Terminated? Ⓝ Ⓨ	Non-mast	Ⓝ Ⓨ	Ⓝ Ⓨ		Non-mast	Ⓝ Ⓨ	Ⓝ Ⓨ	

5. Lateral and Protrusive Movements

		RIGHT SIDE Pain	Familiar Pain	Familiar Headache	LEFT SIDE	Pain	Familiar Pain	Familiar Headache
A. Right Lateral [ ][ ] mm	Temporalis	Ⓝ Ⓨ	Ⓝ Ⓨ	Ⓝ Ⓨ	Temporalis	Ⓝ Ⓨ	Ⓝ Ⓨ	Ⓝ Ⓨ
	Masseter	Ⓝ Ⓨ	Ⓝ Ⓨ		Masseter	Ⓝ Ⓨ	Ⓝ Ⓨ	
	TMJ	Ⓝ Ⓨ	Ⓝ Ⓨ		TMJ	Ⓝ Ⓨ	Ⓝ Ⓨ	
	Other M Musc	Ⓝ Ⓨ	Ⓝ Ⓨ		Other M Musc	Ⓝ Ⓨ	Ⓝ Ⓨ	
	Non-mast	Ⓝ Ⓨ	Ⓝ Ⓨ		Non-mast	Ⓝ Ⓨ	Ⓝ Ⓨ	
B. Left Lateral [ ][ ] mm	Temporalis	Ⓝ Ⓨ	Ⓝ Ⓨ	Ⓝ Ⓨ	Temporalis	Ⓝ Ⓨ	Ⓝ Ⓨ	Ⓝ Ⓨ
	Masseter	Ⓝ Ⓨ	Ⓝ Ⓨ		Masseter	Ⓝ Ⓨ	Ⓝ Ⓨ	
	TMJ	Ⓝ Ⓨ	Ⓝ Ⓨ		TMJ	Ⓝ Ⓨ	Ⓝ Ⓨ	
	Other M Musc	Ⓝ Ⓨ	Ⓝ Ⓨ		Other M Musc	Ⓝ Ⓨ	Ⓝ Ⓨ	
	Non-mast	Ⓝ Ⓨ	Ⓝ Ⓨ		Non-mast	Ⓝ Ⓨ	Ⓝ Ⓨ	
C. Protrusion [ ][ ] mm	Temporalis	Ⓝ Ⓨ	Ⓝ Ⓨ	Ⓝ Ⓨ	Temporalis	Ⓝ Ⓨ	Ⓝ Ⓨ	Ⓝ Ⓨ
	Masseter	Ⓝ Ⓨ	Ⓝ Ⓨ		Masseter	Ⓝ Ⓨ	Ⓝ Ⓨ	
	TMJ	Ⓝ Ⓨ	Ⓝ Ⓨ		TMJ	Ⓝ Ⓨ	Ⓝ Ⓨ	
	Other M Musc	Ⓝ Ⓨ	Ⓝ Ⓨ		Other M Musc	Ⓝ Ⓨ	Ⓝ Ⓨ	
O If negative	Non-mast	Ⓝ Ⓨ	Ⓝ Ⓨ		Non-mast	Ⓝ Ⓨ	Ⓝ Ⓨ	

6. TMJ Noises During Open & Close Movements

RIGHT TMJ	Examiner Open	Examiner Close	Patient	Pain w/ Click	Familiar Pain
Click	(N) (Y)	(N) (Y)	(N) (Y) →	(N) (Y)	(N) (Y)
Crepitus	(N) (Y)	(N) (Y)	(N) (Y)		

LEFT TMJ	Examiner Open	Examiner Close	Patient	Pain w/ Click	Familiar Pain
Click	(N) (Y)	(N) (Y)	(N) (Y) →	(N) (Y)	(N) (Y)
Crepitus	(N) (Y)	(N) (Y)	(N) (Y)		

7. TMJ Noises During Lateral & Protrusive Movements

RIGHT TMJ	Examiner	Patient	Pain w/ Click	Familiar Pain
Click	(N) (Y)	(N) (Y) →	(N) (Y)	(N) (Y)
Crepitus	(N) (Y)	(N) (Y)		

LEFT TMJ	Examiner	Patient	Pain w/ Click	Familiar Pain
Click	(N) (Y)	(N) (Y) →	(N) (Y)	(N) (Y)
Crepitus	(N) (Y)	(N) (Y)		

8. Joint Locking

RIGHT TMJ	Locking	Reduction: Patient	Reduction: Examiner
While Opening	(N) (Y)	(N) (Y)	(N) (Y)
Wide Open Position	(N) (Y)	(N) (Y)	(N) (Y)

LEFT TMJ	Locking	Reduction: Patient	Reduction: Examiner
While Opening	(N) (Y)	(N) (Y)	(N) (Y)
Wide Open Position	(N) (Y)	(N) (Y)	(N) (Y)

9. Muscle & TMJ Pain with Palpation

RIGHT SIDE (1 kg)	Pain	Familiar Pain	Familiar Headache	Referred Pain
Temporalis (posterior)	(N) (Y)	(N) (Y)	(N) (Y)	(N) (Y)
Temporalis (middle)	(N) (Y)	(N) (Y)	(N) (Y)	(N) (Y)
Temporalis (anterior)	(N) (Y)	(N) (Y)	(N) (Y)	(N) (Y)
Masseter (origin)	(N) (Y)	(N) (Y)		(N) (Y)
Masseter (body)	(N) (Y)	(N) (Y)		(N) (Y)
Masseter (insertion)	(N) (Y)	(N) (Y)		(N) (Y)

LEFT SIDE (1 kg)	Pain	Familiar Pain	Familiar Headache	Referred Pain
Temporalis (posterior)	(N) (Y)	(N) (Y)	(N) (Y)	(N) (Y)
Temporalis (middle)	(N) (Y)	(N) (Y)	(N) (Y)	(N) (Y)
Temporalis (anterior)	(N) (Y)	(N) (Y)	(N) (Y)	(N) (Y)
Masseter (origin)	(N) (Y)	(N) (Y)		(N) (Y)
Masseter (body)	(N) (Y)	(N) (Y)		(N) (Y)
Masseter (insertion)	(N) (Y)	(N) (Y)		(N) (Y)

TMJ (Right)	Pain	Familiar Pain	Referred Pain
Lateral pole (0.5 kg)	(N) (Y)	(N) (Y)	(N) (Y)
Around lateral pole (1 kg)	(N) (Y)	(N) (Y)	(N) (Y)

TMJ (Left)	Pain	Familiar Pain	Referred Pain
Lateral pole (0.5 kg)	(N) (Y)	(N) (Y)	(N) (Y)
Around lateral pole (1 kg)	(N) (Y)	(N) (Y)	(N) (Y)

10. Supplemental Muscle Pain with Palpation

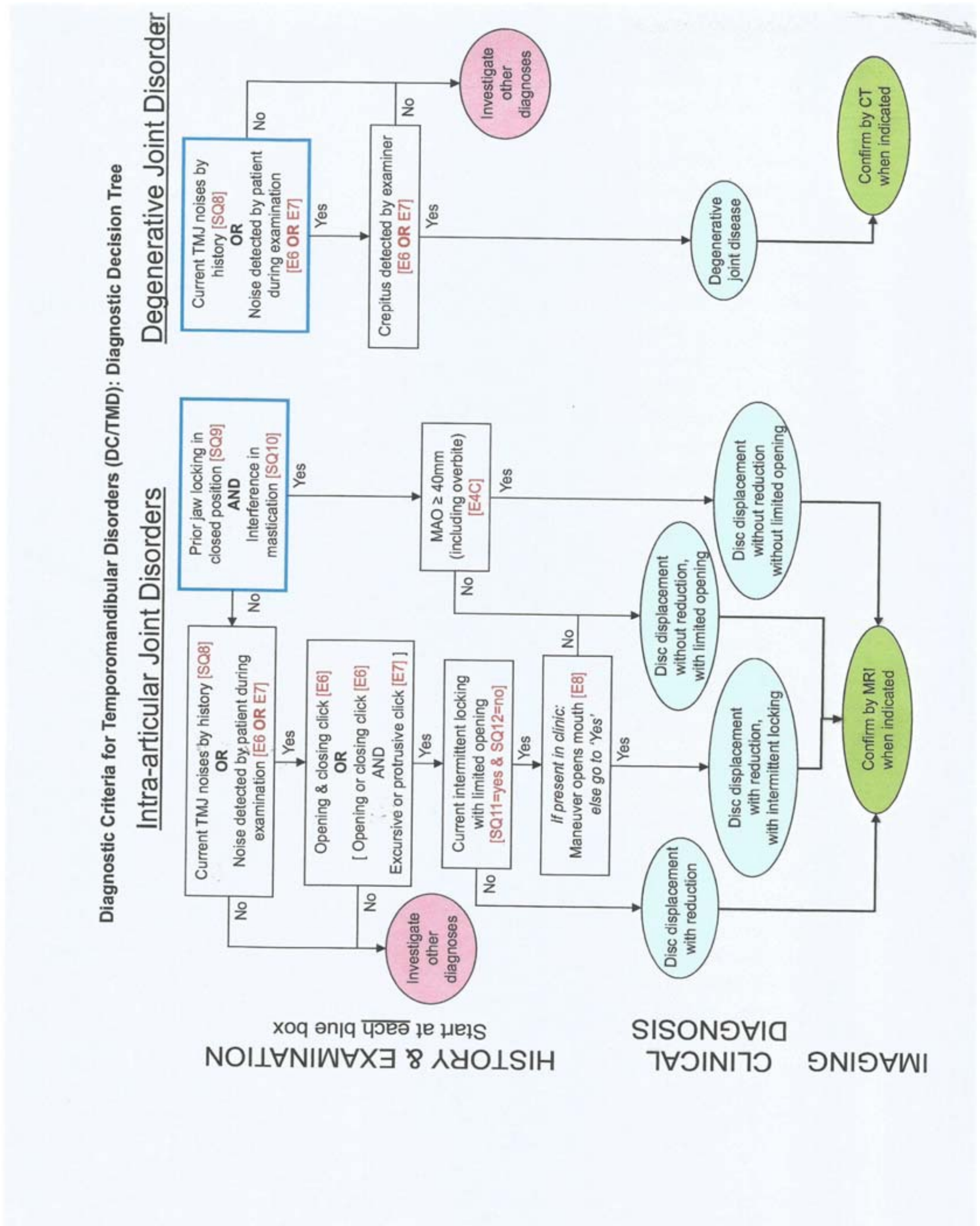
RIGHT SIDE (0.5 kg)	Pain	Familiar Pain	Referred Pain
Posterior mandibular region	(N) (Y)	(N) (Y)	(N) (Y)
Submandibular region	(N) (Y)	(N) (Y)	(N) (Y)
Lateral pterygoid area	(N) (Y)	(N) (Y)	(N) (Y)
Temporalis tendon	(N) (Y)	(N) (Y)	(N) (Y)

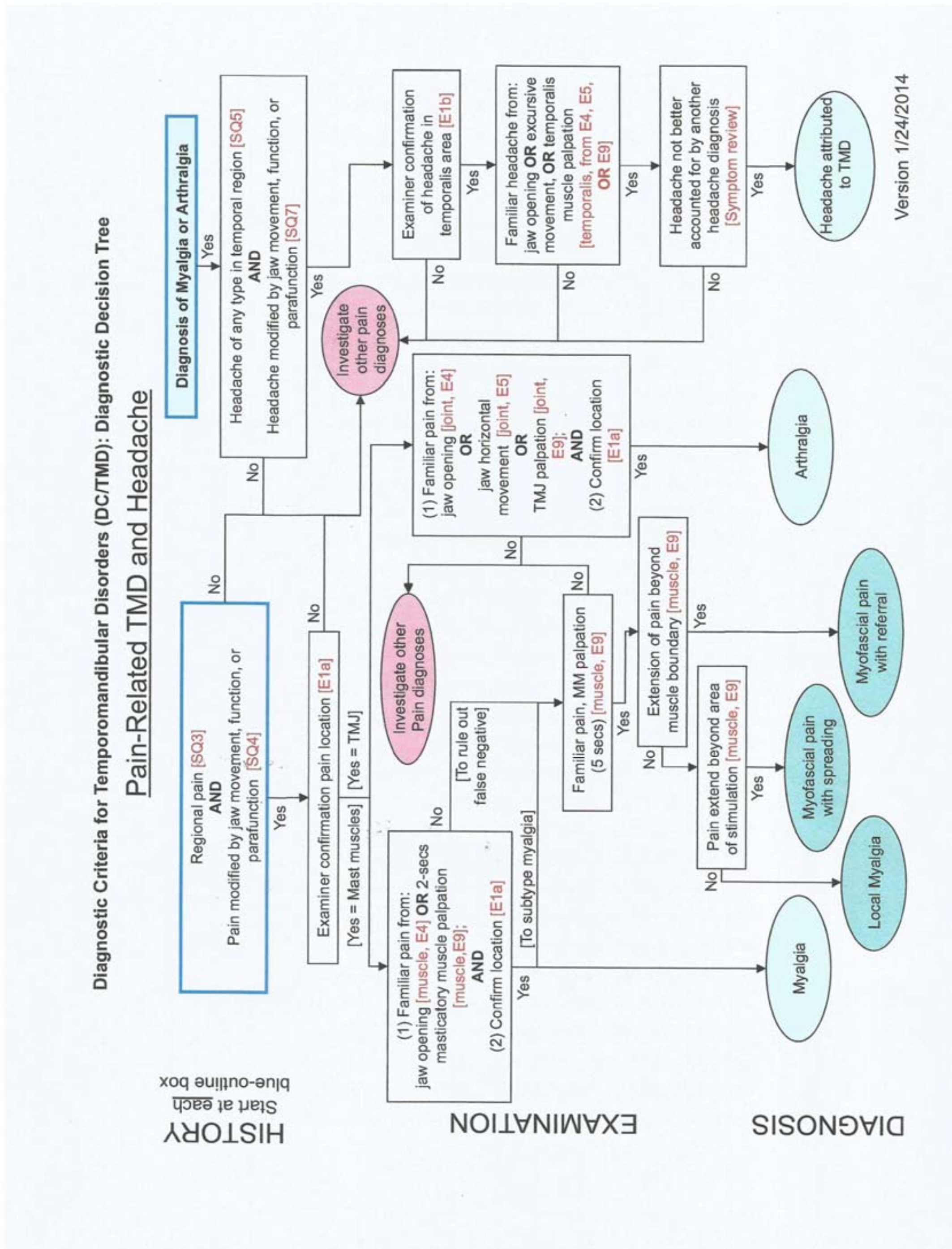
LEFT SIDE (0.5 kg)	Pain	Familiar Pain	Referred Pain
Posterior mandibular region	(N) (Y)	(N) (Y)	(N) (Y)
Submandibular region	(N) (Y)	(N) (Y)	(N) (Y)
Lateral pterygoid area	(N) (Y)	(N) (Y)	(N) (Y)
Temporalis tendon	(N) (Y)	(N) (Y)	(N) (Y)

11. Comments

Appendix 3

Diagnostic Criteria for Temporomandibular Disorders (DC/TMD): Diagnostic Decision Tree




Diagnostic Criteria for Temporomandibular Disorders (DC/TMD): Diagnostic Decision Tree
Pain-Related TMD and Headache
HISTORY
Start at each blue-outline box
EXAMINATION
DIAGNOSIS
Regional pain [SQ3] AND Pain modified by jaw movement, function, or parafunction [SQ4]
Yes
No
Examiner confirmation pain location [E1a]
[Yes = Mast muscles]
[Yes = TMJ]
(1) Familiar pain from: jaw opening [muscle, E4] OR 2-secs masticatory muscle palpation [muscle,E9]; AND (2) Confirm location [E1a]
[To rule out false negative]
[To subtype myalgia]
Familiar pain, MM palpation (5 secs) [muscle, E9]
Extension of pain beyond muscle boundary [muscle, E9]
Pain extend beyond area of stimulation [muscle, E9]
Investigate other Pain diagnoses
(1) Familiar pain from: jaw opening [joint, E4] OR jaw horizontal movement [joint, E5] OR TMJ palpation [joint, E9]; AND (2) Confirm location [E1a]
Diagnosis of Myalgia or Arthralgia
Headache of any type in temporal region [SQ5] AND Headache modified by jaw movement, function, or parafunction [SQ7]
Investigate other pain diagnoses
Examiner confirmation of headache in temporalis area [E1b]
Familiar headache from: jaw opening OR excursive movement, OR temporalis muscle palpation [temporalis, from E4, E5, OR E9]
Headache not better accounted for by another headache diagnosis [Symptom review]
Myalgia
Local Myalgia
Myofascial pain with spreading
Myofascial pain with referral
Arthralgia
Headache attributed to TMD
Version 1/24/2014

الخلاصة

الخلفية:

المفصل الصدغي الفكي هو المفصل الزليلي الذي تربط الفك إلى الجمجمة. وها مفصلان اثنان، يقعان أمام كل أذن. ويتكون كل مفصل من اللقمة من الفك السفلي، القرص، وحديبة المفصلية للعظم الصدغي الحركات المسموح بها هي من جانب إلى آخر، صعودا وهبوطا، فضلا عن نتوء ورجوع. هذا المصل معقد، جنبا إلى جنب مع العضلات المرفقة، يسمح الحركات اللازمة للتحدث، ومضغ، وجعل تعابير الوجه. الألم والاضطرابات الوظيفية المتعلقة بالمفصل شائعة ولكن. لا يوجد على نطاق واسع اختبار مقبول، معيار متاح الآن لتشخيص اضطرابات المفصل بشكل صحيح. لأن الأسباب والأعراض الدقيقة ليست واضحة، وتحديد هذه الاضطرابات يمكن أن يكون صعبا ومربكا.

أهداف الدراسة:

قياس الميل الأفقي العمودي وزاوية بينيت في المرضى الذين يعانون من اضطرابات المفصل، ومقارنة قيمة زاوية بينيت وزاوية العقدة الأفقية باستخدام كاديكس المدمجةII مع اضطرابات مع عوامل مسببة مختلفة سواء عضلي، مفصلي، والصداع الذي يعزى إلى المفصل، واضطرابات القرص داخل المفاصل اضطرابات المفاصل التنكسية مع مجموعة السيطرة.

ربط قيم الميل الأفقي للقمة وزاوية بينيت مع لتصوير المقطعي المحوسب والتصوير بالرنين المغناطيسي في المرضى الذين يعانون من مرض المفاصل التنكسية واضطراب القرص داخل المفصل على التوالي.

الأشخاص والمواد وطرائق العمل:

أجريت الدراسة في "كلية طب الأسنان جامعة بغداد". تراوح عمر المرضى بين 25-55 سنة. تم اعلام جميع المرضى حول الدراسة، والحصول على موافقة مسبقة. تتكون عينة الدراسة من "مائة مريض" مع اضطراب المفصل وعشرين مجموعة تحكم. المرضى الذين يعانون من اضطراب المفصل، وزعت على

الخلاصة

خمس مجموعات وفقا لمعايير التشخيص للاضطرابات الفكية الزمنية 2013. قيم الميل الأفقي لللقمة وزاوية بينيت التي تم الحصول عليها باستخدام كاديكس المدمج II للمرضى والمجموعات الضابطة.

النتائج:

من بين 100 مريض باضطرابات المفصل الصدغي 44 ذكور و56 أنثى و20 مجموعة مراقبة، التي تتكون من 10 ذكور و10 إناث، تتراوح أعمارهم بين 25 و55 سنة مقسمة إلى ثلاث فئات عمرية (25-35-45-55) سنة. علاقة معنوية قائمة بين مجموعة اضطرابات المفصل والسيطرة على الحد الأقصى لفتح الفم بمساعدة وبدونها. والحركات الاستكشافية للفك السفلي مقارنة مع مجموعة السيطرة. أظهرت نتائج التصوير بالرنين المغناطيسي لمجموعة اضطراب القرص داخل المفصل 60٪ من المرضى كان موقف القرص طبيعي في الفم المغلق، وكان 40٪ من نزوح القرص الأمامي. وأظهرت الأشعة المقطعية لمجموعة اضطراب الأمراض التنكسية المشتركة أن 45٪ من المرضى اظهروا تسطح اللقمة، وكان 25٪ تضييق الفضاء، وكان 10٪ من المرضى سماكة تحت الغضروف، وكان 10٪ تشكيل نابِتَةٌ عَظْمِيَّة و10٪ كان تآكل. وأظهرت النتائج انخفاض معنوي في متوسط الميل الأفقي اللقمة مقارنة بمجموعة السيطرة، وانخفاض متوسط قيمة زاوية بينيت من المجموعة المختلة مقارنة بمجموعة السيطرة وعلاقة معنوية للمفاصل اليسرى للمجموعة العضلية الليفية والصداعية.

الاستنتاجات:

قيم الميل أفقي لللقمة لمرض المفاصل التنكسية، ألم مفصلي، الم عضلي، والصداع يعزى إلى المفصل ومرض اضطراب القرص داخل المفصل أقل بكثير من مجموعة السيطرة وبالتالي هذه المعلمة يمكن أن تستخدم في تشخيص اضطراب المفاصل. زاوية بينيت تعني قيمة لمرض المفاصل التنكسية، ألم مفصلي، الم عضلي، والصداع يعزى إلى المفصل ومرض اضطراب القرص داخل المفصل أقل من مجموعة السيطرة وإحصائيا بشكل ملحوظ في المفاصل اليسرى في المجموعة العضلية الليفية والصداع، ويمكن أن تستخدم ككشف أولي. لم توجد علاقة ذات دلالة إحصائية بين نتائج التصوير بالرنين المغنطيسي والتصوير المقطعي لإصابة القرص داخل المفصل ومجموعات اضطراب المفاصل التنكسية فيما يتعلق بالميل الأفقي لللقمة وزاوية بينيت.

جمهورية العراق

وزارة التعليم العالي

والبحث العلمي

جمهورية العراق

تأثير اضطرابات المفصل الصدغي الفكي على قياس زاوية بينيت والميل الأفقي لللقمة يحددها كاديكس المدمجة III في المرضى الذين يعانون من اضطرابات المفصل الصدغي الفكي

رسالة

مقدمة إلى مجلس كلية طب الأسنان جامعة بغداد كجزء من متطلبات درجة الفلسفة في الطب لقسم طب الفم

من قبل

حمزة وليد احمد

بكالوريوس طب وجراحة الفم والاسنان

ماجستير طب الفم

إشراف

الأستاذ الدكتور فواز داوود الأسود

بكالوريوس طب وجراحة الفم والاسنان

ماجستير طب الفم – دكتوراه طب الفم

1438هـ　　　　　　　　2017م

بغداد ـ العراق