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| **Ministry of Higher Education** **and Scientific Research****University of Baghdad** |
| ***The perception of the relationship between temporomandibular disorders and orthodontic treatment among Iraqi dental specialist with different disciplines*** |
| **A graduation project submitted to the Department of Orthodontics- College of Dentistry/ University of Baghdad in partial fulfilment of the requirements for the degree of Bachelor of Dental Surgery** |
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**Certification of the Supervisor**

I certify that this graduation project entitled ”***The perception of the relationship between temporomandibular disorders and orthodontic treatment among Iraqi dental specialist with different disciplines***” was prepared by **Ahmed Kassem (Fifth year undergraduate student** under my supervision at the College of Dentistry/University of Baghdad in partial fulfilment of the requirements for the degree of Bachelor of Dental Surgery.

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**Certification of the examination committee and the dean**

We, the members of the examining committee, certify that after reading the graduation report and examining the student in its contents, it is adequate for the award of the Degree of Bachelor of Dental Surgery.

Chairman

Member Member

# Dedication

***To my Precious ones...***

***My angel mother***

***Soft hearted father***

***Dear grandfather and grandmother***

***My friends***

***To everyone who loved, support and lightened the way for me..***

# Acknowledgement

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# Abstract

The consensus about the relationship between temporomandibular disfunction (TMD) and orthodontic treatment has gone from a cause and effect association between TMD and orthodontic treatment to the idea that there is no reliable evidence supporting this statement. **Aims of the study:** this survey was designed to assess the beliefs of different disciplines of Iraqi specialist, involved in treating patients with TMDs, about the relationship between TMD and orthodontic treatment with regards to treatment, prevention and etiology of TMD. **Materials and method:** A questionnaire was developed and sent to dental specialist members of the College of Dentistry/ University of Baghdad. The questionnaire was distributed directly to Orthodontist, oral surgeons and oral medicine specialists who actively involved in treating temopromandibular disorder. The survey took three weeks from March to April 2017. The questionnaire comprised of questionnaire aimed to collect basic information about each participant and questions was designed to find out their beliefs and clinical management of patients with TMD symptoms. **Results:** the majority of orthodontists believes that there is no relationship between orthodontic treatment and TMDs and that orthodontic treatment did not provoke the risk of TMDs or prevent the onset of the disorder,. However, oral surgeons and oral medicine specialists have different and conflicted opinions. **Conclusion:** Orthodontists belief comes in accordance with the scientific evidence and a series of continuing programme development and specialised centre to receive patients with TMDs is important. Promote the concept of multidisciplinary team approach could improve the health care for those patients.

# Table of contents

[Dedication 1](#_Toc481875835)

[Acknowledgement 2](#_Toc481875836)

[Abstract 3](#_Toc481875837)

[Table of contents 4](#_Toc481875838)

[List of figures 6](#_Toc481875839)

[Introduction 7](#_Toc481875840)

[Aim of the study 8](#_Toc481875841)

[1 Chapter one: Review of literature 9](#_Toc481875842)

[1.1 Temporomandibular joint 9](#_Toc481875843)

[**1.1.1 Definition 9**](#_Toc481875844)

[**1.1.2 Anatomy 9**](#_Toc481875845)

[1.2 Temromandibular disorder 14](#_Toc481875846)

[**1.2.1 Definition 14**](#_Toc481875847)

[**1.2.2 Etiology 14**](#_Toc481875848)

[**1.2.3 Symptoms 16**](#_Toc481875849)

[**1.2.4 Prevalence of TMDs 19**](#_Toc481875850)

[1.3 Effect of malocclusion on TMDS: 23](#_Toc481875851)

[2 Chapter two: Materials and methods 25](#_Toc481875852)

[2.1 Materials 25](#_Toc481875853)

[2.2 Method 26](#_Toc481875854)

[2.3 Statistical analysis 26](#_Toc481875855)

[3 Chapter three: Results 27](#_Toc481875856)

[4 Chapter four: Discussion 32](#_Toc481875857)

[5 Chapter Five: Conclusions and suggestions 34](#_Toc481875858)

[5.1 Conclusions 34](#_Toc481875859)

[5.2 Suggestions 35](#_Toc481875860)

[6 References 36](#_Toc481875861)

[7 Appendix I 42](#_Toc481875862)

# List of figures

[**Figure ‎1‑1: TMJ components 11**](#_Toc481875985)

[**Figure ‎1‑2:Sectional image of TMJ; A, Coronal (frontal) section through the temporomandibular joint (TMJ) in the closed position. B, Sagittal section through the TMJ in the open position 12**](#_Toc481875986)

[**Figure ‎1‑3: Mandibular movement is a complex relationship of rotational and translational movements. A, Closed position. B, Initial opening is rotational. C, Full opening requires forward translation with continued rotation. 13**](#_Toc481875987)

[**Figure ‎3‑1: Gender distribution of the respond rate. 28**](#_Toc481875988)

[**Figure ‎3‑2: participant rate and Professionalism. 29**](#_Toc481875989)

[**Figure ‎3‑3: source of knowledge with regards to disciplines. 30**](#_Toc481875990)

[**Figure ‎3‑4: Interdisciplinary referral data. 30**](#_Toc481875991)

[**Figure ‎3‑5: Respond rate of specialists on whether orthodontic treatment can treat or prevent TMD problems 31**](#_Toc481875992)

[**Figure ‎3‑6: Respond rate of specialists on whether orthodontic treatment can lead to TMD problems 32**](#_Toc481875993)

# Introduction

Temporomandibular disorder (TMD) is relate to the discomfort of the temporomandibular joint (TMJ). The disorder is a multifactorial with a degree of psychogenic influence varying throughout an individual's life with phases of symptoms affecting the quality of life. TMD is not uncommon, and it is believed by many that it may be caused by the underlying occlusion, trauma or psychological stress. Furthermore, there is a belief that the pain associated with TMD is similar, in that respect, to low back pain and may be related to variations of a person's individual pain perception. Changes in the way the teeth meet can be produced by the use of active orthodontic appliances. The exact cause of TMD, however, is not yet clear.

The problems associated with the diagnosis and management of temporomandibular disorders (TMD) have aroused interest to the orthodontist. The attention to signs and symptoms associated with TMD has modified the clinical management before and during orthodontic treatment (Durso et al., 2002).

In the last decade, much effort has been placed to explain the supposed relationship between orthodontic treatment and TMD. Even with the availability

of sophisticated and modern diagnostic tools such as magnetic resonance imaging, and scientific studies with long-term follow-up, it has not yet been possible to eliminate this existing controversy (Conti et al., 2003).

. In an attempt to treat this complex group of disorders, many treatment modalities have been identified. The disorder has a normal cycle of events appearing to spontaneously improve without treatment.

# Aim of the study

To assess the beliefs, despite scientific evidence, of orthodontists, oral surgeons and the oral medicine specialists about the relationship between TMD and orthodontic treatment with regards to treatment and prevention.

# Chapter one: Review of literature

## Temporomandibular joint

### Definition

The temporomandibular joint is the joint of the [jaw](https://en.wikipedia.org/wiki/Jaw), sometimes referred to as the TMJ. It is a bilateral [synovial articulation](https://en.wikipedia.org/wiki/Synovial_joint) between the upper [temporal bone](https://en.wikipedia.org/wiki/Temporal_bone) and the lower [mandible](https://en.wikipedia.org/wiki/Human_mandible); it is from these bones that its name is derived. Each temporomandibular joint is classed as a "ginglymoarthrodial" joint since it is both a [ginglymus](https://en.wikipedia.org/wiki/Ginglymus%22%20%5Co%20%22Ginglymus) (hinging joint) and an [arthrodial](https://en.wikipedia.org/wiki/Arthrodial_joint) (sliding) joint (Alomar et al., 2007). The condyle of the mandible articulates with the [temporal bone](https://en.wikipedia.org/wiki/Temporal_bone) in the [mandibular fossa](https://en.wikipedia.org/wiki/Mandibular_fossa). The mandibular fossa is a concave depression in the [squamous portion of the temporal bone](https://en.wikipedia.org/wiki/Squamous_portion_of_the_temporal_bone). These two bones are actually separated by an [articular disc](https://en.wikipedia.org/wiki/Articular_disc), which divides the joint into two distinct compartments. The inferior compartment allows for rotation of the condylar head around an instantaneous axis of rotation  corresponding to the first 20mm or so of the opening of the mouth. After the mouth is open to this extent, the mouth can no longer open without the superior compartment of the temporomandibular joints becoming active (Moss, 1972).

### Anatomy

The main components of the TMJ are the joint capsule, articular disc, mandibular condyles, articular surface of the temporal bone, temporomandibular ligament, stylomandibular ligament, sphenomandibular ligament, and [lateral pterygoid muscle](https://en.wikipedia.org/wiki/Lateral_pterygoid_muscle) (Figure 1-1) (Balogh and Fehrenbach, 2011).



Figure ‎1‑1: TMJ components (Bath-Balogh and Fehrenbach, 2011)

#### Capsule and articular disc

The capsule is a dense fibrous membrane that surrounds the joint and incorporates the [articular eminence](https://en.wikipedia.org/wiki/Articular_eminence). It attaches to the articular eminence, the articular disc and the neck of the mandibular condyle.

The unique feature of the temporomandibular joint is the [articular disc](https://en.wikipedia.org/wiki/Articular_disc). The disc is composed of a dense fibrous connective tissue that is positioned between the two bones that form the joint. The temporomandibular joints are one of the few [synovial joints](https://en.wikipedia.org/wiki/Synovial_joints) in the human body with an [articular disc](https://en.wikipedia.org/wiki/Articular_disc), another being the [sternoclavicular joint](https://en.wikipedia.org/wiki/Sternoclavicular_joint). The disc divides each joint into two parts. These two compartments are synovial cavities, which consists of an upper and a lower synovial cavity (Figure 1-2). The synovial membrane lining the joint capsule produces the synovial fluid that fills these cavities (Bath-Balogh and Fehrenbach, 2011).



Figure ‎1‑2:Sectional image of TMJ; A, Coronal (frontal) section through the temporomandibular joint (TMJ) in the closed position. B, Sagittal section through the TMJ in the open position

The central area of the disc is avascular and lacks innervation, and, in contrast, the peripheral region has both blood vessels and nerves. Few cells are present, but fibroblasts and white blood cells are among these. The central area is also thinner but of denser consistency than the peripheral region, which is thicker but has a more cushioned consistency. The synovial fluid in the synovial cavities provides the nutrition for the avascular central area of the disc. With age, the entire disc becomes thiner and may undergo addition of cartilage in the central part, changes that may lead to impaired movement of the joint (Bath-Balogh and Fehrenbach, 2011).

The lower joint compartment formed by the mandible and the articular disc is involved in rotational movement, this is the initial movement of the jaw when the mouth opens. The upper joint compartment formed by the articular disc and the temporal bone is involved in translational movement, which is the secondary gliding motion of the jaw as it is opened widely (Figure 1-3). The part of the mandible which mates to the under-surface of the disc is the [condyle](https://en.wikipedia.org/wiki/Condyle_%28anatomy%29) and the part of the temporal bone which mates to the upper surface of the disk is the articular fossa or glenoid fossa or mandibular fossa ([Tsiklakis](http://www.birpublications.org/author/Tsiklakis%2C%2BK) et al., 2014).

The articular disc is a fibrous extension of the capsule in between the two bones of the joint. The disc functions as articular surfaces against both the temporal bone and the condyles. It is biconcave in structure and attaches to the [condyle](https://en.wikipedia.org/wiki/Condyle_%28anatomy%29) medially and laterally. The anterior portion of the disc splits in the vertical dimension, coincident with the insertion of the superior head of the [lateral pterygoid](https://en.wikipedia.org/wiki/Lateral_pterygoid_muscle). The posterior portion also splits in the vertical dimension, and the area between the split continues posteriorly and is referred to as the retrodiscal tissue. Unlike the disc itself, this piece of connective tissue is vascular and innervated, and in some cases of anterior disc displacement, the pain felt during movement of the mandible is due to the condyle compressing this area against the articular surface of the temporal bone.



Figure ‎1‑3: Mandibular movement is a complex relationship of rotational and translational movements. A, Closed position. B, Initial opening is rotational. C, Full opening requires forward translation with continued rotation.

#### Ligaments

There are three ligaments associated with the temporomandibular joints: one major and two minor ligaments (Figure 1-3). These ligaments are important in that they define the border movements, or in other words, the farthest extents of movements, of the mandible. Movements of the mandible made past the extents functionally allowed by the muscular attachments will result in painful stimuli, and thus, movements past these more limited borders are rarely achieved in normal function (Fehrenbach and Herring 2012).



**Figre 1-3: TMJ ligaments (Fehrenbach and Herring 2012).**

The major ligament, the [temporomandibular ligament](https://en.wikipedia.org/wiki/Temporomandibular_ligament), is actually the thickened lateral portion of the capsule, and it has two parts: an outer oblique portion (OOP) and an inner horizontal portion (IHP). The base of this triangular ligament is attached to the zygomatic process of the temporal bone and the articular tubercle; its apex is fixed to the lateral side of the neck of the mandible. This ligament prevents the excessive retraction or moving backward of the mandible, a situation that might lead to problems with the joint (Fehrenbach and Herring 2012 page 118)The two minor ligaments, the stylomandibular and sphenomandibular ligaments are accessory and are not directly attached to any part of the joint.

The [stylomandibular ligament](https://en.wikipedia.org/wiki/Stylomandibular_ligament%22%20%5Co%20%22Stylomandibular%20ligament) separates the infratemporal region (anterior) from the [parotid](https://en.wikipedia.org/wiki/Parotid) region (posterior), and runs from the [styloid process](https://en.wikipedia.org/wiki/Styloid_process_%28temporal%29) to the [angle of the mandible](https://en.wikipedia.org/wiki/Angle_of_the_mandible); it separates the parotid and submandibular salivary glands. It also becomes taut when the mandible is protruded.

The [sphenomandibular ligament](https://en.wikipedia.org/wiki/Sphenomandibular_ligament%22%20%5Co%20%22Sphenomandibular%20ligament) runs from the [spine of the sphenoid bone](https://en.wikipedia.org/wiki/Spine_of_the_sphenoid_bone) to the [lingula of mandible](https://en.wikipedia.org/wiki/Lingula_of_mandible%22%20%5Co%20%22Lingula%20of%20mandible). The inferior alveolar nerve descends between the sphenomandibular ligament and the ramus of the mandible to gain access to the mandibular foramen. The sphenomandibular ligament, because of its attachment to the lingula, overlaps the opening of the foramen. It is a vestige of the embryonic lower jaw, Meckel cartilage. The ligament becomes accentuated and taut when the mandible is protruded (Fehrenbach and Herring, 2012, page 118.)

## Temromandibular disorder

### Definition

TMDs are a cluster of related disorders in the masticatory system with many common features. They encompass a wide range of clinical conditions, often overlapping that may involve the TMJ or the neuromuscular system associated with mandibular function (Dworkin et al., 1990).

### Etiology

Scientific evidence to support a primary etiological factor in TMDs is absent (Helkimo, 1979). Consequently, there is a very little agreement as to the etiology of TMDs, and various theories have been proposed in the dental literature.

These theories, listed in chronological order, are:

1. **Mechanical displacement theory:**

Costen (1934) stressed the idea that distal condylar displacement after loss of posterior teeth led to condylar impingement on the auriculotemporal nerve, or direct pressure on the ear structures and the eustachian tube.

Zimmerman (1951) and Sicher (1955) have pointed out that although direct condylar pressure on the auriculo-temporal nerve itself is not likely, the pain can come from sensitive soft tissue posterior to the condyle due to posterior condylar displacement.

Several clinicians have extended the idea of distal mechanical displacement of the condyle to include both frontal and sagittal changes in condylar position (Kundert & Palla, 1977). The etiologic factors causing the deviation of the condyles out of their normal centric position have been claimed to be loss of molars and premolars, insufficient occlusal contacts in the molar region, premature contacts and occlusal interferences (Zarb & Mohl, 1988).

1. **Neuromuscular theory:**

Any type of occlusal interference can cause parafunctions such as grinding or clenching; however, a background of psychic tension, stress or anxiety is an adjunctive necessary etiologic factor. These parafunctions cause muscle spasm and pain in joints and muscles (Olsson & Krogh-Poulsen, 1966).

Hence, functional disharmony between the dental occlusion and the TMJs is considered by many clinicians as the most acceptable etiologic factor in TMD patients (DeBoever, 1979).

1. **Muscle theory:**

This theory claims that the primary etiologic factor lies in the muscles of mastication themselves. Kraus (1963) described a "hypokinetic disease", which he attributed to the imbalance between a lack of adequate muscle exercise and over stimulation of daily life in this century. He identifies TMDs as only one such disease that can involve the jaws, head and neck. He claimed that under stress, the muscles of the jaw never relax; therefore, tension will increase until a painful spasm occurs. These patients manifest general muscle response in addition to specific ones (Schwartz, 1959).

1. **Psychophysiological theory:**

It supports an opposite opinion to the one proposed in the neuromuscular theory; that is, it maintains that emotional disturbances lead to grinding of teeth which in turn may lead to occlusal interferences. These interferences may then act as sustaining factors (Laskin, 1969). Support for this theory comes from the demonstration of Yemm (1979) that hyperactivity can be centrally initiated and provoked by everyday psychological and social difficulties; also patients can benefit from reassurance, counseling, placebo drugs and splints (Greene & Laskin, 1972).

However, the etiology of TMDs is increasingly accepted as multifactorial with both local or peripheral and central factors being considered of importance (Moss et al., 1995).

Parker (1990) proposed a dynamic model of etiology of TMDs; which he claimed was consistent with both the neuromuscular and the psychophysiological theories because it holds muscle hyperfunction to be central to the pathological process, and it identifies stress and occlusion as contributing factors. The model can, also, accommodate a broad spectrum of multifactorial concepts.

### Symptoms

Several studies have reported symptoms distribution in populations of TMD patients but the main definitional symptoms which have general agreement are the triad: pain and tenderness of the muscles of mastication and the TMJs, sounds during condylar movement, and limitation of mandibular movements accompanied, occasionally, with deviation of the mandible from the normal path of closure (McNeill et al., 1990).

Some investigators have used broader definitions and have included tooth wear, occlusal stability and centric relation discrepancies as possible related indicants of TMDs. Recurrent headache has been considered as a defined symptom (Magnusson & Carlsson, 1978). Furthermore symptoms in the ear, tinnitus and vertigo have also been mentioned (Parker & Chole, 1995).

***The main symptoms could be summarized as followed:***

1. **Pain:**

The most common complaint of patients appears to be pain, and is the most disturbing factor and the most common cause for patient concern and consultation. It is usually aggravated by chewing or other jaw functions (McNeill et al., 1990).

Clinical descriptions of the reported pain vary considerably ranging from dullache to sharp and acute, most often reported to be unilateral although bilateral pain is very common. The locations of the pain may range from the back of the head and neck posteriorly, to the temporal area superiorly, and to the angle of the jaw anteriorly with the most frequently cited pain location being the area in front of the ear (Herb et al., 2006). The pain is minimal in the morning and progressively intensifies during the course of the day (Scott, 1980).

1. **Masticatory muscle tenderness:**

Tenderness of the muscles of mastication as well as related muscles in the head and neck is one of the most common clinical signs of TMDs which is usually not reported by the patient, and almost always elicited by digital palpation of the examiner (Padamsee et aI., 1985).

Tenderness to palpation is mostly attributed to muscle spasm. It is not always possible to record electromyographically an increased activity of these muscles. These tender muscles are recognized as "hot spots" and may be caused by areas of small hemorrhages or tom fibers (Berry & Yemm, 1974).

1. **Joint sounds:**

These are noises that originate from the joint during various mandibular movements, and are of two general types: clicking and crepitation. Joint sounds are very common complaints cited in every report on TMDs, and are significantly more frequent in TMD patients than in the population (Dworkin et aI., 1990).

Clicking is the most frequent reported sound in both patients and population samples. TMJ crepitation is not as common as clicking sounds in population and is often unilateral, while clicking is often bilateral (Hansson, 1986).

The etiology of clicking is not clearly understood but suggested etiologic factors include uncoordinated muscle function of the lower and upper part of the lateral pterygoid muscles, posterior and anterior position of the articular disk, and irregularities of the components of the joint (Wanman & Agerberg, 1990).

1. **Restricted mandibular movements:**

This could be classified into two categories: restricted mouth opening (trismus) and limited lateral movement, and deviations during mandibular movements. Almost all reports agreed that limitation and/or deviation of the mandible are very common (Okeson, 1985).

The limitations of the movements are due to muscle spasm; however, structural changes as limiting factors can occur but they appear to be less frequent. Estimation of the limitation of mandibular movements was made from measurement of maximal opening of the mouth, maximal lateral movements and maximal protrusion. Decreased lateral movement to one side often reflects a disharmony of the contralateral joint (Padamsee et al., 1985).

Deviation of the mandible is towards the affected side, and a forced deviation to the non-affected side is painful.. Deviation of the mandible on opening is usually secondary to muscle spasm or rarely in children or adolescents due to displacement of the meniscus disk (Pillemer et al., 1987).

### Prevalence of TMDs

#### Prevalence according to age:

##### Studies on general populations:

From the available epidemiological studies, it is clear that the signs and symptoms of TMDs are common in general populations; 12-64 % for the symptoms and 20-88 % for the signs among Swedish, Norwegian, Canadian, Hungarian, Indian, and Iraqi populations.

The symptoms of TMDs have been shown to have no correlation with age, except for one study which showed that adult individuals below an age of 44 years were more likely to report one or more symptoms than in the younger age groups (Locker & Slade, 1988). Many epidemiological studies have shown an increase of the signs of TMDs with age ((Tervonen & Knuuttila, 1988), while, Salih (1993) reported no such an increase.

##### Studies on old adults:

The prevalence of subjective symptoms ranged from 60 to 74% and for the clinical signs ranged from 23 to 59%. Heloe and Heloe (1978) showed that the frequency of subjective symptoms tended to increase with age among 65-79 year old adults.

##### Studies on young adults:

The prevalence of TMDs in young adults is generally lower than that in elderly subjects, as the prevalence of the symptoms of TMDs was 12-67% and the prevalence of the signs was 28-42%.

Ingervall and Hedegard (1974) and Molin et al. (1976) reported low prevalence of TMDs among Swedish inductees. On the other hand, Solberg et al. (1979) reported a higher prevalence of TMDs among American University students and he attributed this variation to sex, geographical and cultural factors.

Military and medical Polish student showed a significantly higher prevalence of TMDs than young soldiers of the same age, with the medical students being more affected than the military students (Wigdorowicz-Makowerowa et al., 1979). They attributed these differences to the influence of environment, particularly the type of work performed and responsibility at work.

Several studies assessed the severity of the signs and symptoms of TMDs. Mild and severe symptoms were observed in 15-36% (Pullinger et al., 1988a; Abdulla, 1992).Whereas mild, moderate and severe signs were reported in 1-52% (Droukas et al., 1984; Pullinger et al., 1988a).

##### Studies on adolescents and children:

Epidemiological studies on adolescents and children have shown that TMDs are common in this age group and their prevalence ranged from 0.6% to 74% for the symptoms, and from 4% to 77% for the signs .

The low prevalence of TMDs among Japanese students documented by Motegi et al. (1992) compared with those of Swedish and Polish subjects of corresponding age groups was attributed to cultural factors.

The prevalence of the signs and symptoms of TMDs was shown to increase with age by most investigators (Motegi et al., 1992), except Ohno et al. (1988) who reported a decrease in the prevalence of TMDs symptoms among 10-18 year old Japanese children.

Some investigators have used certain indicies such a Helkimo's indices (Ai & Di) to assess the severity of the signs and symptoms of TMDs and they reported that the prevalence of mild and severe symptoms were 7-13% and 15-40%, respectively (Shereej, 1991); and the prevalence of mild and severe signs was found to be 1-38% and 0-49% resoectively among 15 year olds (Shereej, 1991).

Longitudinal studies on adolescents and children showed that the signs and symptoms fluctuate with age. A significant increase of the prevalence of TMDs symptoms was published by Magnusson et al. (1985) from 7 to 11 years of age, while Heikinheimo et al. (1989) didn’t find such increase.

In conclusion, the signs and symptoms are relatively uncommon in young children but increased gradually with age until adolescence where their prevalence approximates that of adults.

#### Prevalence according to gender:

Many clinical studies showed that females outnumbered males several folds in the population seeking TMJ treatment (Parker & Chole, 1995). This gender difference was attributed to females being less adaptable to the factors leading to hyperfunction or they are less adaptable to its effects. This decreased adaptability in females may be because of structural differences; females having more stressful life events and having more depression than males. In addition to the fact that they are more sensitive to pain than males, or because of the presence of estrogen receptors in the TMJ of females and their absence in male as cited in experiment trials on baboons (Parker, 1990).

Many epidemiological studies on norms have revealed a non-significant gender difference in relation to symptoms of TMDs among young adults (Waltimo & Kononen, 1995), and adolescents and children (Abdulla, 1992). Few investigators reported that symptoms were significantly more common in females (Salih, 1993), but the differences were smaller than those reported in clinical studies. A significant female preponderance in relation to the signs of TMDs was recorded among young adults (Waltimo & Kononen, 1995), and adolescents and children (Shereef, 1991). Other investigators documented a non-significant gender difference (Al-Hadi, 1993); whereas Rao and Rao (1981) reported that the incidence of TMDs was higher in males than in females.

Heloe and Heloe (1975) attributed the overrepresentation of females in clinical matter to inequalities in demand as women are more prone to seek advice and treatment.

#### The most prevalent symptoms:

TMJ sounds was reported in several studies as the most frequent symptom among young adults (Abdulla, 1992), and adolescents and children (Shereef, 1991, Gobal et al., 2014). Pain or tiredness when chewing was reported as the most common symptom by other investigators (Kononen et al., 1987; Widmalm et al., 1995a) and fatigue or stiffness in the masticatory muscles was reported by Pilley et al. (1992) as the most frequent symptom.

The skewed gender distribution of various symptoms of TMDs has been shown in several studies. Females complained more often than males of tiredness of the jaws (Wanman & Agerberg, 1986); TMJ sounds and facial pain (Wanman & Agerberg, 1986d); feeling of fatigue, locking of the jaw, facial and/or jaw pain, pain and/or tiredness on chewing (Shereef, 1991); pain on movement of the mandible (Abdulla, 1992); locking or luxation, clicking and pain around the TMJ (Pilley et al., 1992). TMJ sounds, difficulty in opening of the mouth widely and locking of the jaw (Salih, 1993). TMJ sounds and pain during chewing (Widmalm et al., 1995a).

#### The most prevalent signs:

Many epidemiological studies showed tenderness of the masticatory muscles to palpation was the most prevalent sign among young adults (Abdulla, 1992), and adolescents and children (Pilley et al., 1992).

The most common localization of masticatory muscle tenderness was the lateral pterygoid and insertion of temporalis muscles ((Pilley et al., 1992). The lateral pterygoid was found to be the most frequently tender muscle in many other studies (Wadhwa, 1993). Shereef(1991) and Salih (1993) found that the anterior temporalis and masseter muscles were the most commonly tender muscles.

TMJ sounds, especially clicking, was reported by many other studies as the most frequent sign (Verdonck et al., 1994).

Shereef (1991) and Salih (1993) found no gender difference in relation to TMJ sounds, while muscle tenderness was more frequent among girls, while Pilley et at. (1992) found a significant gender difference in relation to TMJ sounds and not muscle tenderness.

## Effect of malocclusion on TMDS:

Malocclusion has been implicated as an etiologic factor in patients with TMDs, however, the results of correlational studies seeking to verify this relationship have been equivocal. Some found a significant correlation between malocclusion and TMDs (Lieberman et al., 1985); while others have been unable to corroborate these results (Petersen, 1989, Mohlin et al., 2007).

According to electromyographic and kinesiologic studies, malocclusions appear to cause neuromuscular dysfunction and reflex mandibular positioning and contribute to observable disharmonies in chewing patterns (Lundeen, 1982). Because these dysfunctions are sufficient to produce ischaemic circulatory effects, malocclusions may be a significant factor predisposing to TMDs (Egermark et al., 2003).

The basis of support for TMDs occurring as a function of malocclusion comes from two areas:

1. The finding that many TMD patients have malocclusion with more signs and symptoms of TMDs than control subjects (Egermark & Ronnerman, 1995, Egermark et al., 2003).

2. The finding that some TMD patients can be treated successfully by orthodontics and that treatment can reduce the signs and symptoms of TMDs in orthodontic (Olsson & Lindqvist, 1995, Leite et al, 2013).

Malocclusion evaluated in autopsy specimens was weakly associated with morphologic changes in the TMJs, particularly when considered the age. This evidence supports the belief that longer exposure to malocclusion may be associated with more extensive TMJ change (Solberg et al., 1986).

Others claim that malocclusion, per se, does not give rise to TMDs. However, certain types of morphological malocclusion predispose to occlusal interferences and those, according to some, may contribute to their etiology (Corotti-Valle et al., 2004).

# Chapter two: Materials and methods

## Materials

A questionnaire was developed and sent to dental specialists members of the College of Dentistry/ University of Baghdad. The questionnaire was distributed directly to Orthodontist, oral surgeons and oral medicine specialists who actively involved in treating temopromandibular disorder.

The survey took three weeks from March to April 2017, and the participants were free to get in contact with the authors in case of doubts while answering the questionnaire. The questionnaire comprised of questionnaire aimed to collect basic information about each participant and questions was designed to find out their beliefs and clinical management of patients with TMD symptoms.

The surveys include the following question:

1. Gender, age, discipline, post graduate degree and the awarded year of the Participant

2. Questions about his/ her disciplines including the time he/she has been specialist for, the awarded postgraduate degree and where the TMD knowledge has been acquired.

3. Questions about the clinical routine of the professional "Treat or refer patients with TMD”.

4. The final group of question was directed to findout the specialist belief regarding the relationship between orthodontic treatment and TMD syndrome i.e. whether the participant could agree, disagree, or have no opinion were made: "Orthodontics is the best treatment for TMD in patients with skeletal malocclusion": "Orthodontic treatment can prevent the onset of TMD": and "Orthodontic treatment can lead to TMD".

 A sample of the survey questionnaire in appendix I

## Method

This research was approved by the Department of Orthodontics- Collage of Dentistry/ University of Baghdad.

The questionnaire was distributed and collected from the oral surgery, orthodontics, and oral medicine divisions of the College of Dentistry/University of Baghdad.

## Statistical analysis

Descriptive statistic was used to analyse the percentages of respondent who were in favour of each of the survey questions. This was presented using bar charts.

##

# Chapter three: Results

The result of the current study revealed that the participation rate was high (90%). Figure 3-1 shows that the respond rate of the male specialists was low in oral medicine department unlike the oral surgeon when the female represent the lowest rate of participation. However, considering the whole sample, both genders respond equally to this questionnaire survey.

Figure ‎3‑1: Gender distribution of the respond rate.

The majority of orthodontic and oral medicine specialists had a cumulative experience of over 10 years. Whereas, the majority of the oral surgeons, participated in this study, had less professional experience i.e. less than 5 years (Figure 3-2).

Figure ‎3‑2: participant rate and Professionalism.

Figure 3-3 shows how the participant acquired their TMD knowledge. The majority of the participants gained their TMD knowledge from their MSc programme in addition to their undergraduate programme. Self-learning activity accounted for about 15% of the orthodontists who exhibited the least ratio compared to others. Only small proportion of the oral medicine specialist attended specialised TMD courses.

Figure ‎3‑3: source of knowledge with regards to disciplines.

Figure (3-4) shows that almost all the oral surgeons (77%) answer no for the question related to interdisciplinary cooperation. On the other hand, orthodontists tended to refer the patient to specialists. A halve of the oral medicine specialists sent their patients to other speciality (Figure 3-4).

Figure ‎3‑4: Interdisciplinary referral data.

Figure (3-5) shows the data related to the relationship between orthodontic treatment and TMD. Most of the oral medicine and oral surgeon specialists (83% and 70% respectively) believed that orthodontic treatment is best option for TMD patients; additionally, they believed that it prevents the onset of the disorder. Similarly, the agreed that orthodontic treatment could lead to a higher incidence of TMD symptoms. Contrary to that, almost all of the orthodontists (87%) disagreed or didn’t have an opinion regarding the role of orthodontic therapy on TMD treatment. Moreover, a halve of the orthodontists disagreed or have no opinion regarding the role of orthodontic treatment in preventing TMD. However, 75% of them believed that orthodontic treatment didn’t initiate TMD.

Figure ‎3‑5: Respond rate of specialists on whether orthodontic treatment can treat or prevent TMD problems

Regarding the question whether orthodontic treatment can lead to TMD problems, table (3-6) reveals that all of the oral medicine specialist agreed or had no opinion that orthodontic treatment can lead to TMD problems. Similarly, the majority of the oral surgeons (80%) exhibited this belief. Whereas, the majority of orthodontists disagreed with this claim.

Figure ‎3‑6: Respond rate of specialists on whether orthodontic treatment can lead to TMD problems

# Chapter four: Discussion

The use of questionnaires to collect data may have some limitations, such as poor adhesion of participants, which reduces the number of answers, low respond rate and sometimes, inconsistency of the answers (Martins et al., 2011).

**Participation rate**

The results of the current survey showed that the participation rate (90) was higher that reported by the US and UK orthodontist surveys which ranged from 60-70% (Murray et al., 2012). This was possibly due to that all the participants were responded with sympathy since the tidiness of the schedule of the senior year. Moreover, the academic staff seemed more cooperative in responding questionnaire than others (Akrem and Al-Groosh 2016).

Additionally, the respond rate was higher than a similar survey conducted on Brazilian orthodontists (Coelho et al., 2015). This could be due to the simplicity of the questions and the diversity of the target groups.

**Orthodontic treatment in relation to TMD**

The data revealed that the majority of orthodontist believed that orthodontic treatment had no effect on TMD symptoms. However, the oral surgeons and oral medicine specialists had the opposing opinion which comes in disagreement with the finding reported by Leite et al. (2013) who suggested that orthodontic treatment did not provoked the risk to the development of signs and symptoms of TMD, regardless the technique used for treatment and the extraction or non-extraction of premolars.

The orthodontist belief comes in agreement with that reported by (Coelho et al., 2015) where the majority of Iraqi orthodontists opinion was parallel to the scientific evidence.

Having said, that the concept of orthodontic treatment, as a choice to solve TMD symptoms, may be different among disciplines. Both oral surgeons and oral medicine specialist interpreted orthodontic treatment as to solve the malocclusion which predisposed to TMD.

However, Mohlin et al (2010) reported, in his systematic review, that very few researches claimed that there are associations between certain malocclusions and TMD. The majority of the published articles failed to identify any significance and clinically important associations. TMD could not be correlated to any specific type of malocclusion, and there was no support for the belief that orthodontic treatment may cause TMD. Obvious individual variations in signs and symptoms of TMD over time, according to some longitudinal studies, emphasized the difficulty in establishing malocclusion as a significant risk factor for TMD.

Most of the orthodontists (75%) and few oral surgeons (20%) agreed that orthodontic treatment have no effect on provoking TMDs. This comes in accordance with (Mohin et al., 2007, Leitle et al., 2013, Coelho et al., 2015). This comes in parallel with the referral profile of the orthodontists as they believed that causes other than malocclusion may be responsible for the TMDs risk and severity.

The conflicted opinion between the orthodontists from one hand and the other disciplines from the other hand may be due to lack of knowledge updating, continue programme development sessions for TMD subjects and lack the direct communication through specialised centre or clinic.

# Chapter Five: Conclusions and suggestions

## Conclusions

1. The simplicity of the questionnaire may increase the respondents positive reaction especially for senior year of the undergraduate study.

2. Most of the specialist acquired their knowledge about TMD from undergraduate and MSc programmes.

3. Orthodontists belief came in accordance with the scientific evidence regarding the no relationship between orthodontic treatment and TMD symptom and that orthodontic treatment, per se, does not necessarily prevent the onset TMDs.

4. Apart from the orthodontists, most of the participant belief that orthodontic treatment lead to TMDs.

5. The majority of the oral surgeon tried to treat those patients unlike the orthodontists and the oral medicine specialists.

## Suggestions

1. Extending this pilot study to involve orthodontist, oral surgeons and oral medicine specialists in Iraq using e mail with the help of IDA.

2. Raise the specialist awareness about the importance of multidisciplinary team approach to treat patients with TMD problems through a series of CPD and journal club meetings.

3. Establishment of a specialised TMD centre to deal with those patients including orthodontist, oral surgeons and oral medicine specialists.

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# Appendix I

**5th year graduation project College of Dentistry/University of Baghdad**

 **Department of orthodontics**

**A survey on TMJ disorder and orthodontics**

Dear Professors,

We are conducting a survey on the relationship between the temporomandibular joint disorder (TMD) and orthodontics. Your contribution is of great importance to our study.

Many thanks for participation.

**Ahmed kassim**

5th year undergraduate student

1. **Gender** : Male Female
2. **Age:** …………
3. **Discipline (speciality) ………….**
4. **Postgraduate degree**: Master PhD or equivalent Certificate
5. **Where do you practice?** Academic institute Specialised centre Part time private practice
6. **How long have you been a specialist?**
7. Less than one year.
8. 1-5 years.
9. 5-10.
10. More than 10 years.
11. **Your knowledge was acquired during:**
12. Undergraduate dentistry course.
13. MSc programme.
14. TMD course.
15. Self-study.
16. Other course. Please specify………….
17. **Do you refer patient to a specialised centre for treatment?**
18. Yes. Please specify ……….
19. No.

*If the answer is* ***yes*** *please go to question 11*

1. **Have you ever treated a patient with TMD symptoms?**
2. Yes. Please specify …………
3. No.

**10. Have you ever used orthodontic device to treat TMD symptoms?**

1. Yes.
2. No.

**11. Orthodontics is the best treatment for TMD in patients with skeletal malocclusion.**

1. Agree
2. Disagree
3. No opinion about it

**12. Orthodontic treatment can prevent the onset of TMD.**

1. Agree
2. Disagree
3. No opinion about it

**13. Orthodontic treatment can lead to TMD.**

1. Agree
2. Disagree
3. No opinion about it

**Thank you for your participation**