



Digital and Clinical Evaluation of Temporomandibular Disorders in Full Dentition and Free End Extension Patients

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Abstract

Aim of the study: Temporomandibular disorders (TMD) Which are a subgroup of craniofacial pain disorders involving chronic pain, dysfunction of the temporomandibular joint (TMJ), masticatory muscles and associated musculoskeletal structures of the head and neck. Pain is one of the most frequent clinical features for these TMD in addition to the clicking, limitation of mouth opening and deviation. This study aimed to evaluate Digital evaluation of the occlusal instability parameters (Disclusion Time, Occlusion Time, trajectory of force Index and Occlusal Interferences).

Material and method: The study including 180 patients with free end extension and full dentition (kennedy classification class I and II) their age was between (20-50) years old .they had either disc displacement or myofascial pain dysfunction syndrome according to shiffman criteria.and also examined by digital T scan.

Results: The result showed significant pain difference between free end extension and full dentition patients.

Conclusion: The trajectory of force distribution is highly variable between the two major groups, the full dentition exhibit more posterior force while The free end patients tend to establish more anterior force which lead to a series of temporomandibular disorders.

Keywords: Tempromandibular joint, Tempromandibular disorders, Myofacial pain dysfunction syndrome, Tscan.

Introduction:

Temporomandibular Joint (TMJ)is a bilateral synovial articulation between the squamous part of the temporal bone above and the condylar process of the mandible bone below; from these bones the name of TMJ is derived,

The articular disc is located in the space between those two bones (1).

This joint is unique in its shape, structural characteristics and in that it is a bilateral joint

that functions as one unit (2). Many studies approved the significant relationship between some types of malocclusion (missing teeth and imbalanced occlusion) and occurrence of **TMD** Which are a subgroup of craniofacial pain disorders involving pain and dysfunction of the (TMJ), masticatory muscles and associated musculoskeletal structures of the head and neck(3).

Dr. Edward Kennedy created the Classification of edentulism and it is known as the Kennedy classification .it consist of 4



main groups Kennedy class I - Bilateral free-end extensions Kennedy class II - A unilateral edentulous area located posteriorly to the remaining natural teeth. Kennedy class III - A unilateral edentulous area bounded by natural teeth.

Kennedy class IV - A single edentulous area (crossing the midline) located anteriorly to the remaining natural teeth(5)(4).

Till now no study have been conducted in Iraq to assess the relation between occlusal discrepancy in free end extension and the TMD. The study aimed to evaluate Digital evaluation of the occlusal instability parameters (Disclusion Time, Occlusion Time, trajectory of force Index and Occlusal Interferences) and compare between full dentition and free end extension patients.

Subjects materials and methods

The study approval number was (Ref. 432, 27/12/2021, Project No. 432721, College of Dentistry, University of Baghdad), In this study 180 male subjects were selected to participate in the present study according to the inclusion criteria and Diagnostic Criteria for Temporomandibular Disorders (DC/TMD) of Schiffman et al 2014(6) which

is the commonly used diagnostic criteria for TMD, age selected between (20-50) years old. Prior to the procedure, explain the purpose of the examination, obtain consent and be sure to meet infectious control standards. The subjects involved in the study were divided into two main groups:

- Group 1 consist of subjects with free end extention .
- Group 2 consist of subjects with full dentition.

Each group was subdivided into two minor groups:

· Group I Consist of subjects with TMJ internal disc displacement (articular derangement disorder). The Patients were also subdivided into four groups according to the “Diagnostic criteria for temporomandibular disorder clinical protocol and assessment instrument” (6).

Group II: subjects with myofacial pain dysfunction syndrome only (without disc displacement) according to diagnostic criteria and clinical diagnosis (7).

All these groups also diagnosed using T-scan. The T-Scan instrument was designed to examine and record occlusal contacts by computer analysis of information from a

pressure sensitive film. The T-Scan system digitally records both the location and timing of tooth contacts. The tooth contact information is presented by demonstrating moments of time in the sagittal axis and transverse axis of the occlusal plane (Kerstein, 2006)(8). Electrical resistance decreases with the applied force. When the patient occludes on the sensor, the particles come together in the force applied areas, diminishing the electrical resistance (9).

T- Scan system demonstrates sufficient sensitivity and specificity as a diagnostic tool and reliability in intra oral conditions with presence of saliva. It provides registration of dynamic occlusal information (Kerstein, 2001) (10). Computer-based occlusal analyses have many clinical advantages over the articulator-based method (Gözler, 2018) (11).

1. Digital occlusal analysis is usually completed in one session. It can be repeated at another session, if there is a need.
2. Digital occlusal analysis data can be stored and recalled easily, so that many analyses of a single patient can be compared with each other, over time, to

observe changes in the occlusal status as the patient ages.

3. The recording and data acquisition is quick to accomplish chairside, so that many occlusal analyses and corrective adjustments can be performed in same treatment session.
- 4 The cost of performing the occlusal analysis has decreased sharply.

according to the diagnostic criteria for temporomandibular joint disorders, clinical protocol, and assessment instruments the subjects were diagnosed (DC/TMD) (6). All the selected subjects were subjected to a questionnaire about the name, age, past dental procedures, medical history and the usage of any medications. The examination and muscles of mastication and TMJ .the intensity and frequency of pain was determined by VAS scale (visual analog scale) which is the most reliable Numerical rating scale used today This pain evaluation scale allows three pain levels to be determined.

- **<4:** values lower than 4 indicate that the intensity of pain is mild or moderate.

- **4 – 6:** values indicate that the pain intensity ranges from moderate to severe.
- **6:** when the values is greater than 6, the pain severity is serious(7).

Inclusion Criteria

The inclusion criteria were:

1. Subjects of both groups should have six anterior teeth for each arch (upper and lower) with angle class I and II relation
2. Healthy subjects without history or signs and symptoms of any systemic disorders.
3. Subjects with pain in muscles of mastication and /or pain with clicking with/or without limitation of mouth opening
- 4.subjects not taking any analgesic or antiinflammatory medications.

- **Exclusion Criteria :**

- The selection of the subjects based on **exclusion criteria** describe as the following:
- female patients.
- patients with bridges and dentures and mobile teeth (12).

patients with parathyroid gland disease, patients with neoplastic disease, patients with endocrine disorders (13), patients with rheumatoid arthritis and patients with developmental disorders of the TMJ such as condylar aplasia, hypoplasia, or hyperplasia; are not considered for this study(14).

Results

The age distribution for patients in this study ranged from 22 to 50 years old with mean 41 and standard deviation 6.288 as shown in table 1.

Table 1: descriptive distribution

| | N | Minimu m | Maximu m | Mean | Std. Deviation |
|-----------|-----|----------------|-------------|---------------|----------------|
| Age | 180 | 22.00 | 50.00 | 41.1000 | 6.28832 |
| Age group | N | precenta ge | | TMDS | percentage |
| 20-29 | 15 | 8.33% | | Disc disp. | 66.6 |
| 30-39 | 51 | 28.33% | | MPDS | 33.3 |
| 40-50 | 114 | 63.33% | | | |

According to the age groups the pain severity varied from no pain to severe, with

largest group patients is mild pain for patients (age 40-50) as seen in table 2.

Table 2: Age groups * pain severity Crosstabulation

| | | pain severity | | | | Total |
|-----------|-------|---------------|-----------|---------------|-------------|-------|
| | | no pain | mild pain | moderate pain | severe pain | |
| Age group | 20-29 | 5 | 5 | 4 | 1 | 15 |
| | 30-39 | 8 | 25 | 17 | 1 | 51 |
| | 40-50 | 21 | 48 | 38 | 7 | 114 |
| Total | | 34 | 78 | 59 | 9 | 180 |

The pain severity in temporomandibular disorders show that severe pain is only in 9 cases in myofascial pain dysfunction

syndrome, with no cases with no pain for myofascial pain dysfunction syndrome. As seen in table 3.

Table 3: Tempromandibular disorders and pain severity Crosstabulation

| | | percent | pain severity | | | | Total no. |
|-------|------------|---------|---------------|-----------|---------------|-------------|-----------|
| | | | no pain | mild pain | moderate pain | severe pain | |
| TMD S | Disc disp. | 33.3 | 34 | 49 | 37 | 0 | 120 |
| | MP DS | 66.6 | 0 | 29 | 22 | 9 | 60 |
| Total | | | 34 | 78 | 59 | 9 | 180 |

The result of this study showed that there is a variation between these groups, severe pain observed only in 9 cases in free end extension patients with myofacial pain

dysfunction syndrom, while mild pain occupies the largest category in each group. on other hand the no pain had been observed in some patients with internal derangement

patients as seen in table 4.

Table 4: Kennedy classification related to pain severity

| | | pain severity | | | | Total |
|------------------------|----------------|---------------|-----------|---------------|-------------|-------|
| | | no pain | mild pain | moderate pain | severe pain | |
| kennedy classification | kennedy1 | 15 | 30 | 9 | 3 | 57 |
| | kennedy2 | 4 | 13 | 10 | 6 | 33 |
| | full dentition | 15 | 35 | 40 | 0 | 90 |
| Total | | 34 | 78 | 59 | 9 | 180 |

Kennedy class 1 showed that mild pain is the largest sensation in tempromandibular disorders patients. With standard deviation

0.662. and severe pain located only in free end extension patients (kennedy class1 and 2) as seen in figure 1.

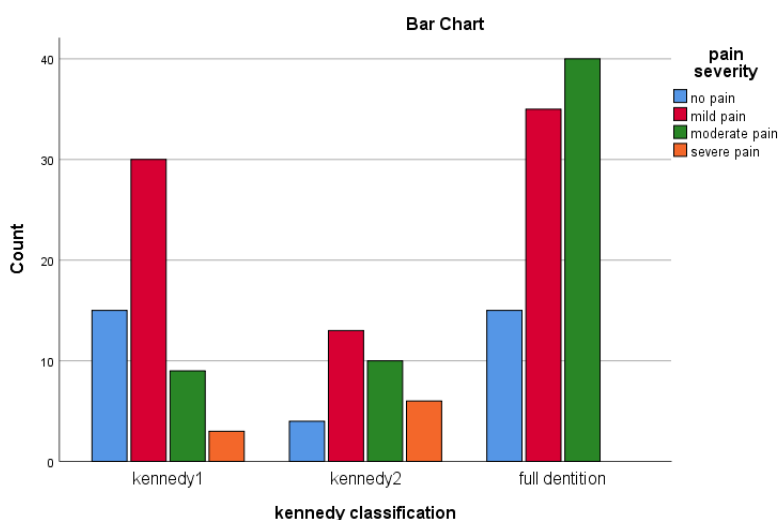


Figure 1: pain severity in patients with Kennedy class 1, class2 and full dentition

Comparisons between Kennedy class 1 , 2

and full dentition statistically resulted that

there is significant difference between class 1 and class 2, and highly significant difference between class 1 and full dentition

patients, while there is non significant difference between class 2 and full dentition patients as seen in table 5.

Table 5: comparisons between full dentition , Kennedy class 1 and class 2

| Sample 1-Sample 2 | Test Statistic | Std. Error | Std. Test Statistic | Sig. | Adj. Sig. ^a |
|-------------------------|----------------|------------|---------------------|------|------------------------|
| kennedy1-kennedy2 | -23.200 | 10.631 | -2.182 | .029 | .087 |
| kennedy1-full dentition | -27.985 | 8.227 | -3.401 | .001 | .002 |
| kennedy2-full dentition | -4.784 | 9.891 | -.484 | .629 | 1.000 |

Table 4.18: Comparison of free end extension with full dentition regarding T scan findings.

| Variable | Free end extension | | Full dentition | | P value |
|------------------------------|--------------------|--------------|-------------------|--------------|---------------------|
| | Frequency N=90 | Percent % | Frequency N=90 | Percent % | |
| Time of occlusion | | | | | |
| Mean±SD | 0.50±0.06 sec. | | 0.48±0.07 sec. | | 0.017* ¹ |
| Time of disocclusion | | | | | |
| Mean±SD | 0.26±0.14 sec. | | 0.27±0.12 sec. | | 0.6011 |
| Force in quadrant | | | | | |
| 1st/3rd | 10 | 11.1 | 0 | 0 | 0.000* ² |
| 1st/4th | 30 | 33.3 | 74 | 82.2 | |
| 2nd/3rd | 50 | 55.6 | 16 | 17.8 | |
| Force right | | | | | |
| Mean±SD | 48.5±16.1 | | 51.6±16.7 | | 0.2221 |
| Force left | | | | | |
| Mean±SD | 51.5±17.9 | | 48.4±16.6 | | 0.1781 |
| Anterior force right | | | | | |
| Mean±SD | 46.1±15.7 | | 28.5±17.2 | | 0.000* ¹ |
| Anterior force left | | | | | |
| Mean±SD | 50.1±17.7 | | 25.5±14.9 | | 0.000* ¹ |
| Posterior force right | | | | | |
| Mean±SD | 2.5±5.6 | | 23.4±10.6 | | 0.000* ³ |
| Posterior force left | | | | | |

| | | | |
|---------|---------|-----------|---------------------|
| Mean±SD | 0.8±3.0 | 24.2±15.8 | 0.000* ³ |
|---------|---------|-----------|---------------------|

*Significant result

¹Independent sample t test

²Chi-square test

³Mann-

Discussion

pain sensation is one of the main symptoms in subjects reported by temporomandibular disorder, about three of four quadrants of them experiencing temporomandibular joint pain or functional disability. Qvintus et al., (2020) showed no significant differences in TMD pain sensation between age groups and this agree with Poveda Roda et al., (2007), Sessle et al., (2008), and Leresche and Drangsholt, (2008) who were documented that problems in TMJ is most common seen in patients who were 20-40(9) while the present study documented that the pain significance was in specific group(40-50).differences in these studies is not surprising, taking into consideration the lack of objectivity in criteria, ethnical factors and demographical variation. in our study, it's the first study that took the start of trajectory force in quadrants using digital T scan, in full dentition the privilege was 1st/4th and in free end extension the 2nd/3rd quadrants, also the deviation in occlusion due to the spacing in the arch show a result of trajectory force in 1st/3rd quadrant, which

happened only in free end extension patients. This study showed that pain severity of myofascial pain dysfunction syndrome is more than in disc displacement, this agree with Bertoli et al(2018) study results, Myofascial pain was the most frequent type followed by internal derangement. This pain intensity in MPDS is due to improper balance in distribution of occlusal forces.

Conclusion

The temporomandibular disorders related positively with the age, there is appositive correlation between TMD and pain intensity. the pain severity is higher in free end dentition patients that develop myofascial pain dysfunction syndrome. There is a significant differences between the free end extension and full dentition. And force distribution in quadrants is highly significant between groups.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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Data Availability Statement

Data are available from the authors upon reasonable request.

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