

# RADIOGRAPHIC CHANGES OF TEMPOROMANDIBULAR JOINT IN PATIENTS WITH CLASS II AND CLASS III SKELETAL MALOCCLUSION BASE ON PANORAMIC RADIOGRAPHIES

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## ABSTRACT

**Aim:** Investigating relationship between changes of temporomandibular joint with occlusion condition is important in identifying fundamental factors of these changes and attempting to find appropriate methods in prevention and treatment. According to a few studies carried out in Iran, this research aimed at studying radiographic changes of temporomandibular joint and their frequency in patients with class II and class III skeletal relationship in panoramic radiographies.

**Materials & Method:** This analytical study is retrospective and performed by radiographies of patients with both lateral cephalometry and panoramic recorded in radiology sector of dentistry department in Jondi-Shapoor university of Ahvaz. Lateral cephalometry of patients were assessed in order to determine skeletal class with STEINER and WITS analysis and divided into 3 classes of I, II, III. Then panoramic radiographies of these patients were evaluated for investigating changes of TMJ joint by two radiologists maxillofacial surgery.

**Results:** Mostly samples of the study, 56.5%, were in occlusion class II. The most prevalent changes of temporomandibular joint belonged to: Remodeling condyle (39.2%), flattening (32.3%) and sclerosis (21%) and hyperplasia condyle (18.82). In addition, results indicated that there is significant relationship between occlusion statuses and some problems of temporomandibular joint.

**Conclusion:** Results of this study indicated that changes of temporomandibular joint in samples had high prevalence and some disorders had higher rate in class II and class III of occlusion. Accordingly, it is recommended to perform more studies on patients considering temporomandibular joint disorders in patients with class II and class III malocclusion.

**Key words:** *Class II Malocclusion, Class III Malocclusion, Changes of temporomandibular joint.*

## Introduction

Temporomandibular joint is formed by mandible condyle lesion and temporal bone glenoid fossa which is located in two side of the skull. These two joints, although have separated anatomy, they are considered as one unit. In joints' space there is a disk formed by cartilaginous fibrous tissue between condyle and glenoid fossa and surrounds a capsule covered with synovial membrane.

Ligaments and muscles restrict motion and let condyle move. Temporomandibular joint disorders are abnormal and interfere with shape of natural performance of joint. These disorders include performance of joint disk, ligaments and related muscles, joint arthritis and growth disorders. Functional disorder of temporomandibular joint is the most prevalent mandibular disorder. Symptoms includes pain in TMJ or ear or both, headache, muscular allergy, joint stiffness, joint clicking or other noises, decrease of joint's range of motion, locking and subluxation. In most cases, these symptoms are temporary and do not need treatment. However, a few patients (5%) suffer from sever disorders such as severe pain and functional disorders. TMJ area disorders are diagnosable when signals such as clinical methods, muscles' numbness, and mandible motions are exposed. However, created disorders and details are identified by radiographic methods.<sup>1,2</sup>

Mandibular skeletal relationships are divided based on angle classification into three groups of I, II and III.<sup>2</sup> According to studies, condyle size, volume, status and its form are different in class I, II, and III.<sup>3,4</sup> Lateral cephalometry

radiography is used for determining skeletal classes.<sup>1,2</sup> Lateral cephalometry radiography is extra oral radiography that determines maxillary and mandibular status rather than skull and their interrelationship.<sup>1</sup> By lateral cephalometry analysis, skeletal relationship can be determined.<sup>2</sup>

According to effect of mandible skeletal relationships on shape, size and condyle morphologic changes, changes caused by TMJ<sup>3,4</sup> and also importance of problems and TMJ disorders and symptomatic of patient, this study aimed at investigating TMJ radiographic changes; including bone osteophytes, flattening and condyle bone abrasion, morphologic changes and condyle remodeling and degenerative joint disease in patients with class II and class III; based on panoramic radiography.

## Literature Review

According to study of Chen *et al* in 2015 in China who aimed at evaluating morphologic facial difference in women with skeletal malocclusion class II, patients with osteoarthritis problem, had least posterior facial height (S-GO) and most angle of mandible plan (SN-MP) and most mandibular Retrognathism. Based on CBCT studies on TMJ osteoarthritis women mostly had skeletal class II disorders.<sup>5</sup>

In 2013, Alves *et al* in Chile performed a research titled as "Morphological Characteristics of the Temporomandibular Joint Articular Surfaces in Patients with Temporomandibular Disorders and the relationship between increasing age-osteoarthritis. They concluded that morphologic changes of TMJ in patients with TMD is very prevalent. And also sclerosis was the most frequent.<sup>6</sup>

Saccucci *et al.*<sup>7</sup> conducted a research in Italy aiming at investigating condylar volume and condylar area in class I, class II and class III young adult subjects with different skeletal patterns and it was identified that there is no difference between left and right condyle. However, people with class III showed a significantly higher condylar volume respect to class II and class I. significantly lower condylar volume was observed in class II subjects, respect to class I and class III.<sup>7</sup>

Mathew *et al.*<sup>8</sup> carried out a research in India titled as "condylar Changes and Its Association with Age, TMD, and Dentition Status: A Cross-Sectional Study". The prevalence of radiographic changes in condylar morphology and symptoms of temporomandibular dysfunction was 81.3% and 18.6%, respectively. Radiographic abnormalities in the mandibular condylar morphology were increased with age. They were seen more frequently in patients with clinical signs and symptoms of temporomandibular dysfunction and in patients with loss of teeth.<sup>8</sup>

Yasaei *et al.*<sup>4</sup> conducted a research in Iran and they investigated height and width of condyle in patients with class III malocclusion and class I by panoramic radiographies and lateral cephalometry. Results indicated that width of condyle in class III malocclusion is less than class I and their difference was significant. So in patients with class III malocclusion, higher growth was observed in condyle height rather than class I and it has less width.<sup>4</sup>

## Materials & Method

The study According to Cohlma JT research,<sup>8</sup> this analytical study is retrospective and is conducted by radiographies of patients with both lateral cephalometric and panoramic recorded in radiology sector of dentistry department in Jondi-Shapoor university of Ahvaz. It should be mentioned that all radiographies were provided by soredex cranexd. Status of lateral cephalometry radiograph was (kvp:73v), (mA:10) and (t:14.6) and for panoramic radiography was (kvp:73v), (mA:10) and (t:17.6). 186 samples were selected randomly.

In this study lateral cephalometric radiographies in order to determine status of patients' skeletal class on negatoscope and this research was analyzed in half dark room on trace paper and pencil. Accordingly, WITS (mm relationship) and (STEINER) analysis (using ANB angle) was used. In order to calculate ANB angle, S, N, A, B points, S-N line and Frankfort plane (F-H) were highlighted. Then SNA and SNB were measured. Difference of both angles which is called ANB is 2 degrees in normal occlusion. Bigger angles indicate jaw inclination toward class II skeletal malocclusion and smaller angles indicate jaw inclination toward class III skeletal malocclusion.

In order to investigate WITS analysis, vertical lines were designed from A and B points on occlusal functional plan (horizontal line was designed from highest contact of premolars and first molars) and contact points were named by occlusal plan BO and AO respectively. In normal relationships these two points are contacted to each other or

B point is placed a little in front of A (A-B: 0 and -1). The more this number becomes positive, the more is relationship between class II and the more is negative this is inclined to class III.

After determining mandibular skeletal class of the sample, panoramic radiography is studied in order to determine temporomandibular joint radiographic changes such as big osteophyte, abrasion, flattening, condyle hyperplasia, condyle hypoplasia, deep antegonial notch, condyle remodeling, Glenoid fossa remodeling, and sclerosis. This was carried out by two maxilafacial radiologist in half-dark room, and one common monitor. Collected data were recorded and they were analyzed. In statistical analysis, data were reported based on frequency and percentage and they were used in order to correlating independent variable in different classes by chi square method and (k square). In addition, multiple logistic was used for providing independent relationship in different classes.

It should be mentioned that considering that response of two observers about temporomandibular joint disorders are highly compatible (90 percent). Thus in this study, positive response of each observer is regarded as lesion presence.

## Results

### a) Occlusion status in samples:

Occlusion Status	Number	Percent
Class I	67	36.0
Class II	105	56.5
Class III	14	7.5
Total	186	100

Table 1: Occlusion status in under studied samples

Most samples, 56%, are in class II occlusion.

### b) Temporomandibular joint disorders status in samples

Osteophyte frequency in samples is 11.8%. Flattening frequency in samples is 32.3%. Frequency of condyle abrasion is 5.9% in samples. Frequency of condyle remodeling is 39.2% in samples. Frequency of glenoid fossa remodeling is 8.6% in samples. Frequency of Condyle hyperplasia is 2.15% in samples. Frequency of Condyle hypoplasia is 18.82% in samples. Frequency of antegonial notch is 11.8% in samples. Frequency of sclerosis is 21% in samples.

### c) Investigating relationship between occlusion status and temporomandibular joint:

In order to investigate relationship between occlusion status and temporomandibular joint, table 2 is provided and they are studied.



Sclerosis	Antegonial notch	Condyle hypoplasia	Condyle hyperplasia	Glenoid remodeling	Glenoid fossa	Condyle remodeling	Condyle abrasion	Flattening	Osteophyte	
147	164	151	182	170	113	175	126	164	No	
39	22	35	4	16	73	11	60	22	Yes	
186	186	186	186	186	186	186	186	186	Total	

Table 2: TMJ disorder's status in sample under study

Table 3 indicates that frequency of osteophyte in class III occlusion samples is higher than other classes. Chi square test indicated that frequency of this lesion in different occlusion classes has statistical significant difference ( $p=0.017$ ).

In addition, frequency of flattening in class I to class III occlusion is growing respectively, however chi square test illustrated that frequency of this lesion in different classes of occlusion has no significant difference ( $p=0.273$ ).

Sclerosis	Antegonial notch	Condyle hypoplasia	Condyle hyperplasia	Glenoid remodeling fossa	Condyle remodelling	Condyle abrasion	Flattening	Osteophyte	Occlusion
q (1.5)	5 (7.5)	6 (8.95)	3 (4.48)	3 (4.5)	18 (26.9)	2 (3.0)	17 (25.4)	2(3.0)	Class I
33 (31.4)	17 (16.2)	26 (24.76)	0 (0.0)	12 (11.4)	48 (45.7)	9 (8.6)	37 (35.2)	17 (16.2)	Class II
5 (35.7)	0 (0.0)	3 (21.43)	1 (7.15)	1 (7.1)	7 (50.0)	0 (0.0)	6 (42.9)	3 (21.4)	Class III
39 (21.0)	22 (11.8)	35 (18.82)	4 (2.15)	16 (8.6)	73 (39.2)	11 (5.9)	60 (32.3)	22 (11.8)	Total

Table 3: Frequency of osteophyte in sample based on occlusion status

Moreover, frequency of condyle abrasion in class II occlusion is higher, however chi square test illustrated that frequency of this lesion in different classes of occlusion has no significant difference ( $p=0.197$ ).

Besides, frequency of condyle remodeling in class III occlusion is higher than other classes, however chi square test illustrated that frequency of this lesion in different classes of occlusion has significant difference ( $p=0.033$ ).

On the other hand, frequency of glenoid fossa remodeling in class II occlusion is higher than other classes, however chi square test illustrated that frequency of this lesion in different classes of occlusion has no significant difference ( $p=0.279$ ).

An also, frequency of Condyle hyperplasia in class III occlusion is higher than other classes, however chi square test illustrated that frequency of this lesion in different classes of occlusion has no significant difference ( $p=0.0682$ ).

And also, frequency of Condyle hypoplasia in class II occlusion is higher than other classes, chi square test illustrated that frequency of this lesion in different classes of

occlusion has significant difference ( $p=0.008$ ). in addition, frequency of deep Antegonial notch in class II occlusion is higher than other classes, however chi square test illustrated that frequency of this lesion in different classes of occlusion has no significant difference ( $p=0.0682$ ). Finally, frequency of sclerosis in class III occlusion is higher than other classes, chi square test illustrated that frequency of this lesion in different classes of occlusion has significant difference ( $p=0.000$ ).

## Results

Investigating changes of temporomandibular joint in samples of the study indicated that frequency of osteophyte and condyle remodeling in class III occlusion samples is higher than class II and class I. it means that when occlusion class is increased, frequency of these two lesion is growing and this difference was statistically significant ( $p<0.05$ ).

In addition, frequency of sclerosis is higher in class III occlusion and this difference was statistically significant in all 3 classes ( $p<0.001$ ).

Moreover, results indicated that frequency of condyle hyperplasia in class II occlusion is significantly higher in other classes ( $p<0.05$ ). However, results did not indicate statistically significant difference in frequency of flattening, condyle abrasion, glenoid fossa remodeling, condyle hyperplasia and deep Antegonial notch with a person's occlusion ( $p>0.05$ ), although in most cases frequency of these lesions was higher in class II occlusion.

Investigating changes of temporomandibular joint in samples of the study indicated that frequency of osteophyte in samples was 11.8%, flattening was 32.3%, condyle abrasion was 5.9%, condyle remodeling was 39.2%, glenoid fossa remodeling was 8.6%, condyle hyperplasia was 8.1%, condyle hypoplasia was 15.6%, deep Antegonial notch was 11.8% and sclerosis was 21.0%.

## Discussion

One subject of interest for professionals and researchers in recent years is investigating relationship between TMD exposure and people occlusion status in order to provide some evidence for representing fundamental factors related to these disorders and then finding good methods of prevention and treatment. Researching on occlusion status illustrated that most samples, 56%, are in class II occlusion, 36% are in class I and 7.5% are in class III.

Saccucci *et al.*<sup>7</sup> performed research in Italy aiming at investigating condylar volume and condylar area in young adult subjects with different skeletal patterns. 200 samples were divided into three classes including class I, class II and class III which formed frequency of class I patients, 65 patients, class II, 70 patients and class III 65 patients.<sup>7</sup>

Accordingly, study performed by Alves *et al.*<sup>6</sup> it is clear, highest frequency of temporomandibular joint changes in this study is designated to condyle remodeling, flattening, and sclerosis and condyle hypoplasia. On Morphological characteristics of the temporomandibular joint articular

surfaces in patients with temporomandibular disorders and the relationship between increasing age-osteoarthritis. Results indicated that 28.94% studied joints are normal, 55.26% had sclerosis 52.63% had flattening and 52.63 had condyle abrasion, 50% had Osteophyte, 39.46% had condyle remodeling and 7.89% had glenoid fossa.<sup>6</sup> In this study Osteophyte, sclerosis and flattening are the most prevalent observed disorders in TMJ.

In addition, Mathew *et al.*<sup>8</sup> performed a research on condylar changes and its association with age, TMD, and Dentition Status. The most prevalent change was related to flattening with 80% frequency then Osteophyte with 16% and sclerosis with 12% and erosion with 8% and Ely's cyst with 6.7% (46%). In addition, in Hiltunen *et al* study (2002) and Takayama *et al* (2008) the most prevalent radiographic result were observed in flattening, erosion, Osteophyte, sclerosis respectively.<sup>9,10</sup>

These findings are kind of similar with our results which showed that the most prevalent TMD include condyle remodeling, flattening, sclerosis, however difference in frequency of these lesions in different studies is due to assessment method, different characteristics of assessors and more importantly demographic and racial aspects.

Different researches studied relationship between a person occlusion status and temporomandibular joint morphology and its disorders. For example, Henrikson (1990) reported that people with normal occlusion showed the least frequency in TMD symptoms in compare to class II patients who always showed highest frequency in these disorders.<sup>11</sup>

Chen *et al* in 2015 in China evaluated morphologic facial difference in women with skeletal malocclusion class II, patients with osteoarthritis problem. Samples were divided into three groups based on condylar shape: 1) normal group 2) group that do not definitely have osteoarthritis Problems 3) people with osteoarthritis. Results of this study indicated that 52.4% of patients had osteoarthritis which changed condylar structure. In addition, some results which concluded that TMJ disorder in patients with class II occlusion which it was similar to our results because in this study frequency of TMJ lesion in class II patients was more. Based on CBCT studies on TMJ osteoarthritis women mostly had skeletal class II disorders.<sup>5</sup>

Yasaei *et al.*<sup>4</sup> performed a research in Iran and they investigated height and width of condyle in patients with malocclusion class III and class I by panoramic radiographies and lateral cephalometry. Results indicated that width of condyle in malocclusion class III is less than class I and their difference was significant. So in patients with malocclusion class III had higher growth in condyle height rather than class I and it has less width.<sup>3</sup> It should be mentioned that studies on temporomandibular joint and its relationship with patient's occlusion status, different indices are used and different lesion are considered. Accordingly, comparing results of this study is different with some other studies in some fields which are due to case studies.

## Conclusion

Results of this study indicated that temporomandibular joint changes is highly prevalent in samples and they had disorders such as: condyle remodeling, flattening, sclerosis. In addition, results indicated that some disorders such as osteophyte, condyle remodeling and sclerosis in class III samples are higher than class II and class I and frequency of condyle hyperplasia are significantly higher in class II occlusion than other classes. However, there was no significant difference between frequencies of flattening, condyle abrasion, glenoid fossa remodeling, condyle hyperplasia and deep Antegonial notch with a person class occlusion status, and although in most cases frequency of these lesion in class II occlusion was higher. According to above information, it is recommended to perform more researches on patients and temporomandibular joint in class II and class III occlusion patients.

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