DOI: https://doi.org/10.53350/pjmhs2216886

ORIGINAL ARTICLE

Anatomical Consideration of Temporomandibular Joint, Condylar position among subjects with Skeletal Malocclusion

NABEELA HABIB[1], ASMA RAFI CHAUDHRY[2], NIDA ASAD DAR[3], HAFSA GUL[4], KHURRAM SHEHZAD[5], MUHAMMAD USMAN GHANI[6]
[1]Assistant Professor, Department of Anatomy, Avicenna Medical College,
[2]Assistant Professor, Orthodontics Department, Institute of Dentistry, CMH, Lahore Medical College,
[3]Registrar, Orthodontics Department, Institute of Dentistry, CMH, Lahore Medical College,
[4]Assistant Professor, Orthodontics Department, Avicenna Dental College,
[5]Senior Registrar, Orthodontics Department, Avicenna Dental College,
[6]Senior Registrar, Orthodontics Department, Lahore Medical & Dental College,
Correspondence to Dr. Nabeela Habib, Email: nabeelahabib@hotmail.com, Contact # 03005150701

ABSTRACT

Aim: To investigate the association between anatomical considerations of TMJ with regard to condylar positioning in Glenoid Fossa and prevalence of malocclusion in patients with TMDs
Methods: A thorough investigation was done by collecting data on CT scans of 37 patients with TMDs and their Condylar positioning was recorded. Data on malocclusion was obtained by cephalometric radiographs and the relationship was observed.
Results: Our study showed a significant ($p<0.05$) presence of bilateralism in anterior positioning as well as in posterior positioning. Class II showed significant bilateralism of posterior positioning ($n=12$, $p<0.05$) whereas Class III showed significant bilateralism of anterior positioning ($n=7$, $p<0.05$) of condyles.
Conclusion: Our study on anatomical consideration of TMJ and positions of condyles concluded a significant relevance with orthodontic malocclusion. Posterior positioning of condyles may contribute to Class II whereas anterior positioning of condyles may lead to Class III malocclusion.
MeSH Words: Condylar Positions, Malocclusion, TMJ Anatomy.

INTRODUCTION

Temporomandibular joint is the major joint contributing to opening and functioning of the oral cavity and other functions including phonation, mastication and facial expressions[1]. This bilateral joint acts as hinges on both sides of face involving mandible and temporal bones. Importance of Condylar morphology and positioning are well established in proper functioning of TMJ and hence it can be a good indicator for prevalence of malocclusion types[2]. In order to clinically assess Temporomandibular joints, several radiological modalities are used that include Computer Tomography Scans (CT scan), transcranial radiographs (TRANS) and lastly Magnetic Resonance Imaging (MRI). Among mentioned above modalities, CT Scans are widely accepted method to verify morphology and positioning of condyles[3]. These diagnostic modalities also play important role in diagnosing of Temporomandibular disorders (TMD)[4].

Condylar positioning has been regarded as a major etiological factor in skeletal deformities in occlusion. Condylar positioning in glenoid fossa is crucial in opening and closing of oral cavity as well as in resting position[5]. The variables involved in dynamics of condyle and fosse relationship are growth patterns, variations in left and right musculature and bony structures, responses to functional variations and alteration in occlusion. The temporal sequence in establishing the causality between Condylar position in TMJ anatomy and skeletal malocclusion is very hard to carry out because of involvement of growth patterns with age[6]. Shape and size of condyles also fluctuate with age and show disparities among genders and races. These variations may be attributed to morphological changes because of remodeling processes to adjust or accommodate malocclusion, trauma and bruxism[7].

Changes in anatomy and morphology of TMJ can also influence midline symmetry of maxilla-mandibular structures leading to dental malocclusion e.g. crowding, unilateral or bilateral dental crowding and midline shift[8]. The concept of association between condylar positioning and Angle's classification comes under a multifactorial causation system. Current scientific literature reviews such association either as causative or risk factor or confounding factor. It makes it essential to look at the causative factors of condylar positioning in developmental stages[9].

Rational for our study also pivots on the related researches that showed pathological conditions of condyles may also effect the occlusion that include metastatic and resoptive changes in condylar bone structure[10, 11]. This study intended to find the prevalence of anatomical alterations of TMJ in the form of changes in condylar position among subjects with malocclusion. Data available on such association in Pakistan is scarce and there is very little literature at hand for Pakistani population.

Received on 03-02-2022
Accepted on 13-07-2022

MATERIALS AND METHODS

We started our study after ethical committee permission with search of patients who have historically been subjected to Computerized Tomography scan for TMJ and associated structures. For this, different dental teaching institutes were reached out for list of patients with TMD. Moreover, records from different radiological and diagnostic centers of Lahore were sought out and CT scans reports were studied with the written approval and informed consent of patients. We excluded the patients with TMJ trauma and pathological conditions of bones. With such data sampling technique, we were able to manage 37 patients to be included in the study. After acquisition of CT scan reports, every participant was called for an orthodontic examination where a trained orthodontist examined and took lateral cephalometric radiographs and impressions of dentitions. Radiographically, positions of condyle or condylar-fossa relationship was given scores in accordance with normal anatomical landmarks and considerations. For reference, central point of neck of condyle in Glenoid fossa was chosen as representative placement. Posterior positioning of condyles as compared to normal concentric position in Glenoid fossae was given -1 score. Whereas, anterior positioning of condyles as compared to physiological concentric position was given +1 score. Concentric position of condyles was given a score 0.

For occlusal parameters, molar relationship were classified using Angle's classification into class I, class II and class III using later cephalometric radiographs. Such classification was restricted to skeletal malocclusion only in our study. We also incorporated single blind technique for classification of skeletal malocclusion and scoring of condylar positioning. SPSS software version 24.0 was fed with data and it analyzed it using Analysis of Variance (ANOVA). For statistical analysis references, probability (p-value) of less than 0.05 was used for significance level determining.

RESULTS

The mean age of the sample set of 37 individuals was 23.12±3.9 years. 21(56.75%) the patients were female and 16(43.24%) patients were male. No statistical difference was found between age and gender of the patients and class of malocclusion. The findings of this study were based on CT scan reports of bilateral condylar positions. Out of 37 participants, 10 were Class I malocclusion, 18 were Class II and 9 were

Class III malocclusion. The comparison of condylar positions between Male and Female showed no statistical differences (P value: 0.329). On CT scans of Class I patients, condyles were positioned in normal concentric placement. Observations of CT scans of participants with Class II malocclusion were in more variation. 5 of Class II, Division 2, 3 patients showed mild unilateral posterior disposition of condyles. However, 13 of Class II, Division 1 showed significant posterior locale of condyles in the fossa bilaterally at rest. It was also observed that the length of condyles on Class II patients were recorded to be shorter than those in Class I and III. Among Class III patients, all of the dispositions of condyles were bilateral. CT scans showed slight to severe dispositions of condyles, placed anteriorly among 8 class III patients as compared to Class I and Class II. This anterior positioning in class III was found to be significant (p value <0.05) as compared to other participants. The frequent scoring of +1 among Class III patients was universally and profoundly observed in the group. The comparison of condylar positions between Male and Female showed no statistical differences (P value: 0.329).

Table 2 shows the comparison of unilateral and bilateral condylar positions among patients. This bilateral comparison also included differentiation of Class II Div. 1 and Class II Div. 2. This comparison showed that a significant presence of bilateralism in Anterior positioning as well as in posterior positioning. Class II showed significant bilateralism of posterior positioning whereas Class III showed significant bilateralism of anterior positioning of condyles.

Table 1: Frequency distribution of Condylar disarrangement (N=37)

Angle's Classification	n	Anterior position	Posterior position	Concentric
Class I	10	0	0	10
Class II Div. 1	13	1	12	0
Class II Div. 2	5	2	3	0
Class III	9	8	1	0

Table 2. Comparison of unilateral and bilateral condylar positioning

Angle's Classification (n)	Anterior Position		Posterior Position		P-value
	Unilateral	Bilateral	Unilateral	Bilateral	
Class I (10)	All Class I participants were concentric				
Class II Div. 1 (13)	0	1	3	9	<0.05
Class 11 Div. 2 (5)	0	2	0	3	<0.05
Class III (9)	1	7	1	0	<0.05

DISCUSSION

Our study not only assessed prevalence of anatomical alterations of TMJ in the form of changes in condylar position among subjects with malocclusion but also quantified the relation of unilateral and bilateral changes in condylar positioning. Class II malocclusion are often seen as majorly represented among TMJ patients, causing posterior displacement of condyles[12]. This study emphasized on such very fact with significant results of bilateral posterior positioning specially among Div. 1 patients. Our research study also showed that concentric condylar position is invariably a characteristic of Class I occlusion. Whereas, nonconcentric condylar positioning is a prominent characteristic of Class II and Class III malocclusion. These findings are a summary of relationship skeletal dislocation of TMJ and malocclusion and were also verified by a multiple Asian and non-Asian studies[13, 14]. Detrimental effects of anatomical variation in positions of condylar heads in Glenoid fossae also leads to Temporomandibular Disorders (TMDs)[15]. We can label this risk factor as common risk factor to Malocclusion and TMDs. Variations in vertical positioning of Condyles in Glenoid Fossae may act as confounding factor between the exposure and the outcome. However, anteroposterior positioning of condyles has been found to be more significantly associated with TMD[16].

It is pertinent to mention that debate on temporal causation between condylar displacement and malocclusion is subject to extensive research that may start as early as condylar development. This leads to another discussion of Surgery first or Orthodontic first approach among orthodontists17. The distal position and relationship of the mandible cannot be synonymized with posterior displacement of condyles. Our study didn't consider midline deviation and asymmetric mandibular position in relationship with condylar positions and malocclusion.

Strengths of this study included the observations on anteroposterior positioning in unilateral and bilateral sides and including patients with Class II division 2 malocclusion. However, this study didn't adjust vertical dispositioning of Condyle-Glenoid relationship. A future study with comprehensive anteroposterior and vertical measurements with degree of deviation in anteroposterior and vertical planes is recommended to establish a sound scientific association.

CONCLUSION

This study statistically and significantly concluded that TMJ anatomical consideration in regards with Condylar positions is associated with development of Class II and Class III malocclusion. Though temporality of such association isn't clear, it can be used in the management of malocclusion and TMDs.

Funding: Nil
Conflict of Interests: None
Contribution:
Conceptualization and design of Study: Dr. Nabeela Habib
Data Collection: Dr. Khurram Shehzad, Dr. Muhammad Usman Ghani
Data Analysis and data interpretation: Dr. Hafsa Gul
Drafting & Manuscript Writing: Dr. Nida Asad Dar
Proof reading and referencing: Dr. Asma Rafi Chaudhry
Manuscript Writing: Dr. Omair Anjum

REFERENCES

1. O'Ryan F, Epker BN. Temporomandibular joint function and morphology: observations on the spectra of normalcy. Oral surgery, oral medicine, oral pathology. 1984 Sep 1;58(3):272-9.
2. Pietra LC, Santiago MD, Valerio CS, Taitson PF, Manzi FR, Seraidarian PI. Use of transcranial radiograph to detect morphological changes in mandibular condyles. Revista CEFAC. 2017 Jan;19:54-62.
3. Anisuzzaman MM, Khan SR, Khan MT, Abdullah MK, Afrin A. Evaluation of mandibular condylar morphology by orthopantomogram in Bangladeshi population. Update Dental College Journal. 2019 Apr 27;9(1):29-31.
4. Larheim TA, Hol C, Ottersen MK, Mork-Knutsen BB, Arvidsson LZ. The role of imaging in the diagnosis of temporomandibular joint pathology. Oral and Maxillofacial Surgery Clinics. 2018 Aug 1;30(3):239-49.
5. Chae JM, Park JH, Tai K, Mizutani K, Uzuka S, Miyashita W, Seo HY. Evaluation of condyle-fossa relationships in adolescents with various skeletal patterns using cone-beam computed tomography. The Angle Orthodontist. 2020 Mar;90(2):224.
6. Zere E, Chaudhari PK, Sharan J, Dhingra K, Tiwari N. Developing Class III malocclusions: challenges and solutions. Clinical, cosmetic and investigational dentistry. 2018;10:99.
7. Ouni I, Ammar S, Charfeddine A, Chouchen F, Mansour L. Evaluation of condylar changes in relation to various malocclusions: A systematic review. Saudi Journal of Oral Sciences. 2021 Sep 1;8(3):129.
8. Roque-Torres GD, Peyneau PD, da Costa ED, Bóscolo FN, de Almeida SM, Ribeiro LW. Correlation between midline deviation and condylar position in patients with Class II malocclusion: A cone-beam computed tomography evaluation. American Journal of Orthodontics and Dentofacial Orthopedics. 2018 Jul 1;154(1):99-107.
9. Michelotti A, Rongo R, D'Antò V, Bucci R. Occlusion, orthodontics, and temporomandibular disorders: Cutting edge of the current evidence. Journal of the World Federation of Orthodontists. 2020 Oct 1;9(3):S15-8.
10. Oliver C, Mouallem G, Dutot-Philipeau N, Longis J, Piot B, Bertin H. A case report of condyle metastasis and a review of the literature. Journal of Stomatology, Oral and Maxillofacial Surgery. 2021 May 7.
11. Cascone P, D'Alessandro F, Gallo E, Cicero G, Vellone V. The Role of Three-Dimensional Printing Technology as an Additional Tool in Unilateral Condylar Hyperplasia Surgical Planning. Journal of Craniofacial Surgery. 2020 Oct 1;31(7):e735-8.
12. Wei RY, Atresh A, Ruellas A, Cevidanes LH, Nguyen T, Larson BE, Mangum JE, Manton DJ, Schneider PM. Three-dimensional condylar changes from Herbst appliance and multibracket treatment: A comparison with matched Class II elastics. American Journal of Orthodontics and Dentofacial Orthopedics. 2020 Oct 1;158(4):505-17.
13. Rivero-Millán P, Barrera-Mora JM, Espinar-Escalona E, González-del Pino CA, Martín-Salvador D, Llamas-Carreras JM. Comparison of condylar position in normal occlusion, Class II Division 1, Class II Division 2 and Class III malocclusions using CBCT imaging. Journal of clinical and experimental dentistry. 2021 Dec;13(12):e1216.
14. Sreenivasagan S, George AM, Rengalakshmi S. Variation in condylar morphology in different malocclusion among Indians. Bioinformation. 2021;17(12):1134.
15. Shokri A, Zarch HH, Hafezmaleki F, Khamechi R, Amini P, Ramezani L. Comparative assessment of condylar position in patients with temporomandibular disorder (TMD) and asymptomatic patients using cone-beam computed tomography. Dental and medical problems. 2019;56(1):81-7.
16. Guercio Monaco E, De Stefano AA, Hernandez-Andara A, Galluccio G. Correlation between condylar size on CT and position of the articular disc on MRI of the temporomandibular joint. CRANIO®. 2022 Jan 2;40(1):64-71.
17. He X, He J, Yuan H, Chen W, Jiang H, Cheng J. Surgery-first and orthodontic-first approaches produce similar patterns of condylar displacement and remodeling in patients with skeletal class III malocclusion. Journal of Oral and Maxillofacial Surgery. 2019 Jul 1;77(7):1446-56