Original Article

Evaluation of the influence of mandibular condylar contour, height, and asymmetry in subjects with myalgia presenting with or without clicking among south coastal Karnataka population – A descriptive cross-sectional study

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Abstract

Aim: The purpose was to evaluate the morphological variations of the condyle in patients presenting with myalgia associated with and without clicking of *temporomandibular joint* (TMJ) and its possible effect on the contour and height.

Setting and Design: Cross sectional study.

Material and Methods: A total of 60 patients comprising of 20 patients with myalgia, 20 patients with myalgia associated with clicking of TMJ, and a control group of 20 patients without any signs and symptoms of temporomandibular disorder were selected for purpose of the study. Using a digital panoramic radiograph, the contour of the condyle was evaluated for shape, condylar height (CH), and condylar asymmetry.

Statistical Analyses Used: Chi-square test, One- way ANOVA.

Results: Rounded contour of the condyle was the most prevalent shape of the condyle amongst the three groups. There was a significant decrease in mean right and left CH in subjects with myalgia (0.71 cm and 0.73 cm) and subjects with myalgia associated with clicking (0.65 cm and 0.62 cm) compared to control group subjects. There was also an increase in the mean asymmetry index in subjects with myalgia presenting with clicking (2.362 ± 1.4) and without clicking (1.388 ± 2.1) ($P < 0.05$).

Conclusion: Within the limitations of the current study, round contour of the condyle is the most common variant. Subjects with myalgia showed a significant reduction in condyle height. Condyle contour, height, and asymmetry may not predispose the joint for clicking.

Keywords: Condyle asymmetry, condyle contour, panoramic radiographic assessment

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Submitted: 18-May-2020, **Revised:** 17-Sep-2020, **Accepted:** 30-Nov-2020, **Published:** 29-Jan-2021

Access this article online	
Quick Response Code:	Website: www.j-ips.org
	DOI: 10.4103/jips.jips_255_20

How to cite this article: Chandhok A, Hegde C, Shetty M, Shetty G. Evaluation of the influence of mandibular condylar contour, height, and asymmetry in subjects with myalgia presenting with or without clicking among south coastal Karnataka population – A descriptive cross-sectional study. J Indian Prosthodont Soc 2021;21:81-7.

INTRODUCTION

The stomatognathic system comprises of highly coordinated structures involving the teeth, the muscles of mastication, and the temporomandibular joint (TMJ).[1] It is vital to have a comprehensive understanding of the structure and morphology of TMJ. It forms the basis of clinical practice which aids in differentiating a normal variant from an abnormal condition and also helps in understanding pathological alterations.[2] As an initial imaging technique for TMJ examination, panoramic radiography has been used as a straightforward and helpful method for evaluating condyle abnormalities as well as morphology.[2]

Myalgia is the most prevalent muscular disorder in dental practice, accounting for 60%–70% of temporomandibular disorders (TMDs).[3] Numerous authors suggested the most common causes of myalgia would include parafunctional habits such as clenching, bruxism, and emotional factors such as anxiety and depression.[4] The patient might present with myalgia associated with or without clicking in the joint.

The dimensions of the parts of the TMJ and their association with each other vary greatly. It is frequently presumed that there must be a convex configuration throughout the normal condylar head and that there should be symmetry in the same individual between the contralateral sides.[2] When the condyle is observed from a superior view, it appears approximately ovoid in shape. The mediolateral dimension is 15–20 mm and 8–10 mm posteroanteriorly.[2] Several studies have tried to evaluate human condyle morphology. The first varied forms of mandibular condyle were reported by Yale *et al*.[5] They classified the head of the condyle into convex, flat, and concave, based on superior view. Chaudhury *et al*. classified the shape condyle as diamond, oval, crooked finger, and bird beak.[2] However, these classifications only described the variation in the normal shape of the condyle in subjects without any signs and symptoms of TMD. Hence there was a need to evaluate the morphological variations of the condyle in subjects with TMD and its possible effect on contour and height.

Different age groups and individuals showcase mandibular condyles of several forms which can be attributed to a developmental variability or remodeling of the condyle to compensate for malocclusion variations during development or any other diseases. Among the structural alterations that can be a risk factor of TMD is condylar asymmetry.[6] Condylar asymmetry has been thought by few researchers as a cause of overburdening of joint surfaces affecting tissues that compose them, whether these are soft or hard. It is also said to trigger hyperactivity in masticatory muscles. Therefore, the detection of condylar asymmetry is of importance.[7]

This study makes an attempt to differentiate condylar form in patients presenting with masticatory muscle myalgia associated with and without clicking in the joint. In the past, studies were conducted to evaluate the influence of condylar shape, height, and asymmetry on subjects with either myalgia or internal derangement. No research in the past has considered to study patients with myalgia as well as combined effects of myalgia along with internal derangement. This study makes an attempt to evaluate the possible influence of condylar contour, height, and asymmetry as a predisposing factor to myalgia and internal derangement.

MATERIALS AND METHODS

Source of data

The study was conducted on a total of 60 patients reporting to the Department of Prosthodontics and Crown and Bridge with a chief complaint of pain in the region of the TMJ. Informed consent from the participant was obtained to participate in the study and use the data for the purpose of research. Ethical committee approval (Cert. No: ABSM/EC26/2017) was obtained from the institutional ethical committee under the guidelines of adherence to the Helsinki Declaration (Article 14), before the commencement of the study. The timeframe of the study ranged from November 2017 to June 2019.

Inclusion criteria

- Patients with age group of 18–55 years.
- Subjects with no previous history of rheumatic disorders, fractures, and surgery.
- Subjects with myalgia associated with clicking in the joint.
- Subjects with myalgia without clicking in the joint.

Exclusion criteria

- Subjects suffering from any neurologic disorders.
- Subjects with chronic systemic illness.
- Subjects with chronic muscle pain and orofacial pain disorders.
- Subjects with a previous history of treatment done (medication, splints, surgery).

The participants of the study were divided into three groups:

Group A: Subjects suffering from masticatory muscle myalgia without clicking in the joint.

Group B: Subjects suffering from masticatory muscle myalgia with clicking in the joint.

Group C: Subjects without any signs and symptoms of TMDs. (control group).

The diagnosis for myalgia was confirmed using Research Diagnostic Criteria for TMDs (RDC/TMD Axis I).[8]

Radiograhic parameters

A digital panoramic radiograph using Planmeca Promax™ (exposure parameters of 70–80 kvp and 8 mA) made for the diagnostic purpose of the patients with myalgia was used. Control Group radiographs were retrieved from the archives database of subjects without any TMDs.

Using Planmeca Romexis Software 2.4.2 R™ the outline of the condyle was traced starting from the neck of the condyle anteriorly passing over the superior surface followed by a posterior outline through the posterior border of ramus up to the angle of the mandible. The highest point of contour on the anterior surface of the condyle was marked as O1 and the highest point of contour on the posterior surface was marked as O2. Later, the highest point of convexity of the ramus of the mandible was marked as O3. Point O1 and O2 were connected and the contour of the condyle was divided into three equal parts of 60 degrees as shown in Figure 1. The shapes were classified according to Honda *et al*.[9] into

- Anterior surface (round, flat, angulated)
- Upper surface (round, flat, angulated)
- Posterior surface (round, flat, angulated) as shown in Figures 2-4.

The condylar asymmetry index was measured using the Habets technique.[10] Line A was constructed connecting points O2 and O3 as shown in Figure 5. A perpendicular line B was drawn to the line A from the most superior most point of the condyle. The distance was measured between the point of intersection of the perpendicular Line B with the Line A and O2. It was named as the condylar height (CH). To express the symmetry between the condyles and the rami on the OPG image, the following formula was used:

Asymmetry index (AI) = CH right – CH left/CH right + CH left × 100.

The condyles were classified as asymmetric when the asymmetry index (percentage) is greater than 6%.

Sample size estimated using the formula:

$$n = \frac{Z\,(1-\alpha\ /\ 2)\times P\times Q}{d^2}$$

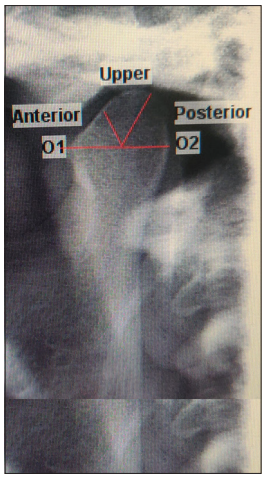

Figure 1: Assessment of morphology of condyle

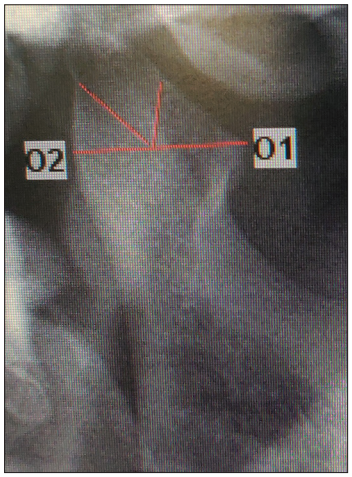

Figure 2: Flat contour of condyle

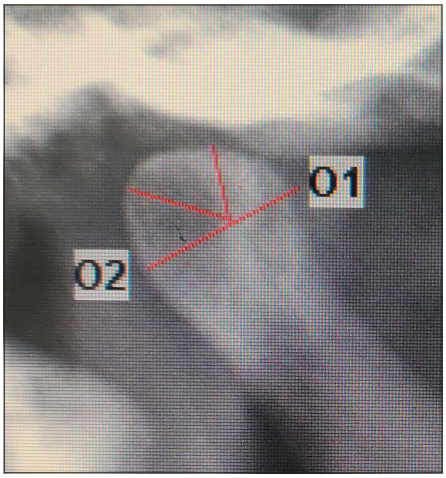

Figure 3: Round contour of condyle

Statistical analysis

Using the Chi-square test intergroup comparison of the shape of the condyles was performed. The heights of the condyles and the mean asymmetry index were compared using one-way ANOVA test. $P < 0.05$ was taken as statistically significant.

Statistical software

Software SPSS version 22.0 IBM Corporation, New York, USA was used.

RESULTS

When the shape of the right condyle was compared among the three groups 61.7% of the condyles had a rounded contour. Flattening was observed in 23.9% whereas angulated contour was seen in 14.4 % of condyles as seen in Table 1.

When the shape of the left condyle was compared among the three groups 61.11% of the condyles had a rounded contour. Flattening was observed in 22.22% of the condyles whereas angulated contour was seen in 15.8 % of condyles as seen in Table 2.

The mean height of the right condyle (1.24 cm) in the control group was significantly higher than the mean CH in both groups of subjects with myalgia presenting with clicking (0.65 cm) and without clicking in the joint (0.71 cm) as seen in Table 3.

The mean height of the left condyle (1.22 cm) in the control group was significantly higher than the mean CH in both groups of subjects with myalgia presenting with clicking (0.62cm) and without clicking in the joint (0.73 cm) as seen in Table 4.

There was also an increase in the mean asymmetry index in subjects with myalgia presenting with clicking (2.362 ± 1.4) and without clicking (1.388 ± 2.1) as seen in Table 5.

DISCUSSION

The accurate diagnosis of morphological variations in different parts of the TMJ may enable the early diagnosis of joint disorders and subsequently a successful treatment; all of these diagnoses rely on having knowledge about normal and abnormal joint anatomy.

Christiansen *et al.* determined condyle shape by means of computed tomography on the coronal plane (corresponding to posterior view), found flattened shapes in 34%, convex

Table 1: Comparison of shape of right condyle among the three groups

Group	Shape of condyle			Total
	Angulated	Flat	Round	
A				
Count	10	15	35	60
Percentage within group	16.7	25	58.3	100
B				
Count	12	22	26	60
Percentage within group	20	36.7	43.3	100
C				
Count	4	6	50	60
Percentage within group	6.8	10	83.3	100
Total				
Count	26	43	111	180
Percentage within group	14.4	23.9	61.7	100

P=0.003

Table 2: Comparison of shape of left condyle among the three groups

Group	Shape of condyle			Total
	Angulated	Flat	Round	
A				
Count	11	11	38	60
Percentage within group	18.3	18.3	63.3	100
B				
Count	12	23	25	60
Percentage within group	20	38.3	41.7	100
C				
Count	5	8	47	60
Percentage within group	8.3	13.3	78.3	100
Total				
Count	28	40	110	180
Percentage within group	15.6	22.2	61.11	100

P=0.0008

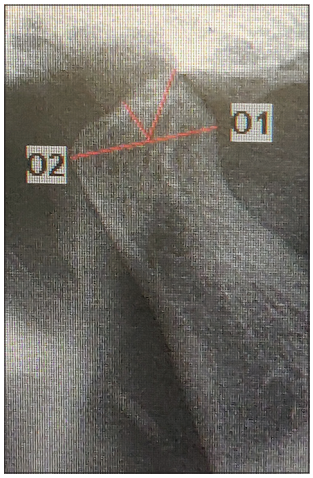

Figure 4: Angulated contour of condyle

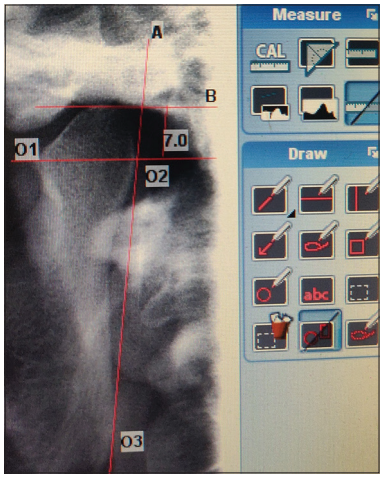

Figure 5: Assessment of height of condyle

Table 3: Comparison of height of right condyle among three groups

Group	Mean (cm)±SD	Factor (I)	Factor (J)	Mean difference (I-J)	*P*	95% CI for difference	
						Lower bound	Upper bound
A	0.710±0.197	A	B	−0.060	0.631	−0.217	0.097
B	0.650±0.167		C	0.450	0.000	0.292	0.607
C	1.24±0.391	B	C	0.590	0.000	0.384	0.795

SD: Standard deviation, CI: Confidence interval

Table 4: Comparison of height of left condyle among three groups

Group	Mean (cm)±SD	Factor (I)	Factor (J)	Mean difference (I-J)	*P*	95% CI for difference	
						Lower bound	Upper bound
A	0.7±0.2	A	B	−0.110	0.284	−0.283	0.063
B	0.6±0.2		C	0.490	0.000	0.317	0.663
C	1.2±0.3	B	C	0.600	0.000	0.427	0.773

SD: Standard deviation, CI: Confidence interval

Table 5: Comparison of condyle asymmetry index among the three groups

Group	Mean asymmetry index (%)±SD
A	1.388±2.1
B	2.362±1.4
C	0.813±2.5

P=0.879. SD: Standard deviation

in 43%, angled in 19%. On the axial plane, they found ellipsoid shape in 40%, convex in 40%, and ovoid in 20%.[11] Also by means of computed tomography, Raustia & Pyhtinen standardized condyle shapes, finding, on the coronal plane, A1 shape (rounded or slightly convex) in 60% of patients with TMD and 50% in the control group; A2 (extensively flat - straight) in 22% and 29% respectively; A3 (peak shape – inverted V) in 8% and 19% respectively; A4 (other shapes) in 10% and 2% respectively.[12] Thus it can be seen that the condyle is not uniformly round even in normal individuals.

In the current study, most of the subjects among all the three groups showed round right and left condyle contour (61.7%) (61.1%). The above findings were similar to the study conducted by Singh *et al*. where a greater frequency of the rounded shape in orthopantomogram (41%) followed by angled (28%), flattened (19%), and mixed (12%) type, respectively, was seen in a group of subjects without any signs and symptoms of TMD.[13] Subjects with myalgia as well as myalgia with clicking showed increased flattening of condyle head compared to the control group, but this variation statistically not significant. So flattening of the condylar contour may not be a predisposing factor in TMD. Functional remodeling may have resulted in the flattening of the condylar head in both the study group. Thus rounded appearance is the most common variant of condylar contour. This is further supported by a study conducted by Mathew *et al*. 80 % of the subjects had a flattened appearance of the condyle.[14] Sato *et al*. studied the association between condylar changes and TMDs where the common most finding was flattening of the condyle.[15] Hiltunen *et al*. conducted a 5-year follow-up study to determine the relation between TMD and radiographic findings and found that flattening was most common along with osteoarthrosis.[16] Takayama *et al*. compared bone changes between patients with and without TMDs and concluded that changes were more common in TMD patients (17%) than in non-TMD patients (11%).[17]

In the current study patients presenting with myalgia associated with and without clicking in the joint showed similar right CHs of 0.650 cm and 0.710 cm. But the right CH of 1.24 cm in the control group was significantly higher. Similarly, the left CH of 1.22 cm in the control group was significantly higher compare to the height of 0.620 cm and 0.730 cm in patients with myalgia associated with and without clicking in the joint respectively. It may be noted there is no significant variation in CH between subjects with myalgia associated with and without clicking. Thus reduced CH is a common factor in myalgia with or without associated clicking. Thus CH variation may be a predisposal factor resulting in myalgia but may not play a major role in disc displacement. Overburdening due to reduced CH may trigger the hyperactivity of masticatory muscles which may result in myalgia.[7]

According to Hintze *et al*. decrease in height of the mandibular condyle is the first change that occurs in individuals with complaints of clicking.[18] Luz *et al*. reported a significant difference in CH between TMD patients and asymptomatic individuals.[19] Buranastidporn *et al*. revealed a significant correlation between the degree of mandibular vertical asymmetry and the internal derangement symptoms of TMJ.[20] Result interpretation of CH in myalgia subjects with clicking is contrary to the result of other authors discussed above.

In the context of mandibular asymmetry, many suggestions have been made to describe how much difference can be characterized as the asymmetry between the two TMJ. Bezuur *et al*. stated that 74% of TMD patients had a vertical condylar asymmetry higher than 3%, which was actually higher in myogenic TMD patients than in arthrogenic patients.[21] Saglam and Sanli reported that the asymmetry index of Habets in muscle origin TMD patients was 11.11 % compared to that of Habets *et al*. in articular TMD patients with an average of 7.3 %.[7] The average Habets' asymmetry index in patients in the above study was 12.8% being in proximity to the previous results. Similar results were observed in the present study, patients with myalgia associated with clicking showed asymmetric index of 2.362 ± 1.4, and subject with only myalgia showing 1.388 ± 2.1 compared to the control group with 0.813 ± 2.5. Although the asymmetric index in the study group was more than the control group, it was far less than the studies conducted earlier as discussed above. Hence, with no great variation between the control and study groups, condyle asymmetry may not play a role as etiologic factor resulting in myalgia with and without clicking.

Clicking in the TMJ is generally associated with disc displacement with reduction. This usually occurs due to the elongation of the discal ligaments. Discal ligament elongation often results due to macro trauma, thus condyle height and condyle asymmetry as discussed in the study may not play a significant role in disc displacement. However, when the disc is displaced, a considerable amount of load would be placed on the head of the condyle. This may cause flattening of the surface of the condyle.[22] The study conducted by Dias *et al*. also showed a statistically significant correlation between the anterior displacement of the disc and associated bone changes such as flattening.[22]

The findings of the current study implicate round contour of the condyle is the most common variant, short condyle height may be a predisposing factor to myalgia. Patients without the recurrent problem of myalgia may not show marked condylar asymmetry. Contour and height of condyle may not be predisposing factors resulting in elongation of discal ligament and further to disc displacement.

Strength and limitations of the study

An attempt is made for the first time to study influence condyle contour, height, and asymmetry in myalgia subjects with and without clicking of TMJ. The outcome of the study is able to state morphological variations of condyle do influence myalgia but not internal derangement of TMJ as no significant variation is seen between the two study groups.

Orthopantomogram image may generate a distortion up to 2 % of the TMJ.[10] However, as the distortion was uniform for all the radiographs being taken may not have affected the result of the study significantly. Although CBCT imaging modality could have been more accurate, because of higher radiation exposure of routine screening procedure of the control group, this imaging modality was avoided.[23]

CONCLUSION

Within the limitations of the current study round contour of the condyle is the most common variant. Subjects with myalgia showed a significant reduction in condyle height. Condyle contour, height, and asymmetry may not predispose the joint for clicking.

Scope for future research

The findings of the current study suggest condyle height reduction may be predisposing factor resulting in myalgia. It will be of interest to study remodeling of condyle contour and height after resolving myalgia as very often recurrence of myalgia is often common.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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