ISSN: 0976-3031

Available Online at http://www.recentscientific.com

CODEN: IJRSFP (USA)

International Journal of Recent Scientific Research
Vol. 9, Issue, 10(B), pp. 29162-29165, October, 2018

International Journal of Recent Scientific Research

DOI: 10.24327/IJRSR

Research Article

MORPHOLOGICAL ASSESSMENT OF VARIATIONS OF CONDYLAR HEAD AND SIGMOID NOTCH ON ORTHOPANTOMOGRAMS OF KASHMIRI POPULATION

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DOI: http://dx.doi.org/10.24327/ijrsr.2018.0910.2804

ARTICLE INFO

Article History:

Received 12th July, 2018
Received in revised form 23rd August, 2018
Accepted 7th September, 2018
Published online 28th October, 2018

Key Words:

Condylar process, orthopantomogram, sexual dimorphism, sigmoid notch

ABSTRACT

This retrospective study was conducted using 348 Conventional Orthopantomograms of patients to evaluate radiologically sexual dimorphism by assessing morphological variations of condylar process and sigmoid notch on orthopantomograms in kashmiri population. Different shapes of condylar process and sigmoid notch were traced using marker pencil for both right and left sides of jaw. The data obtained were subjected to statistical analysis, Chi-square test was done to evaluate the *P* value which was ascertained to be statistically significant if <0.05. The most common condylar shapes observed among the males and females were round shapes. The sigmoid notch most commonly observed was round form followed by sloping and wide form in both the gender. These variations observed between gender had shown statistical significance and in relation to sides had shown no statistically significant differences. The Present study has shown variations seen radiologically for different morphological shapes of condylar process and sigmoid notch pertaining to KASHMIRI population. By knowing the variations helps in determination of sex of a particular individual and also helps in the diagnosis of pathologies in those regions.

INTRODUCTION

Temporomandibular Joint (TMJ) is the freely movable diarthoidal joint and is one of the unique joints of the body present between the condyle of the mandible and squamous portion of the temporal bone located at the base of the skull.[1] In the face mandible is the largest and the strongest bone having horizontally curved body that is convex forward and two broad rami that ascend posteriorly. The rami bear the coronoid and condyloid processes. The condyle is very important as growth and development of mandible is provided by mandibular condyle. The sigmoid notch also called as mandibular notch is a deep notch separating the coronoid process and condyloid process.[2]

Variations in the appearance of the mandibular condyle among different age groups and individuals have been observed. These morphologic changes may occur because of simple developmental variability or due to remodeling of condyle to accommodate developmental changes, malocclusion, trauma and other developmental abnormalities and degenerative pathologies. Numerous studies have been done on TMJ morphology using dry and autopsy human skulls, histology, Orthopantomograms (OPGs) ,magnetic resonance imaging, computed tomography and Cone-Beam Computed Tomography methods [3, 4].

A thorough knowledge and understanding of the anatomy and morphology of the TMJ is essential so that a normal variant is distinguished from pathological conditions. The current research focuses to evaluate sexual dimorphism on assessing the morphological variations of mandibular condylar process and sigmoid notch in kashmiri population.

MATERIALS AND METHODS

A retrospective study was conducted in the Department of Oral Medicine and Radiology, govt dental college Srinagar. Institutional Ethical Clearance was obtained. A total of 348 OPGs were included in the study of the patients undergoing conventional OPGs needed for diagnosis of their, periodontal, surgical (for impacted teeth) or orthodontic problems. Patients having history of trauma to maxillofacial region and developmental abnormalities like hemifacial atrophy were excluded from the study. All OPGs were taken by New-Tom VGi Scanner (QR srl; Verona, Italy) in standard resolution mode (tube potential:50-85KV, tube current:12mA, and

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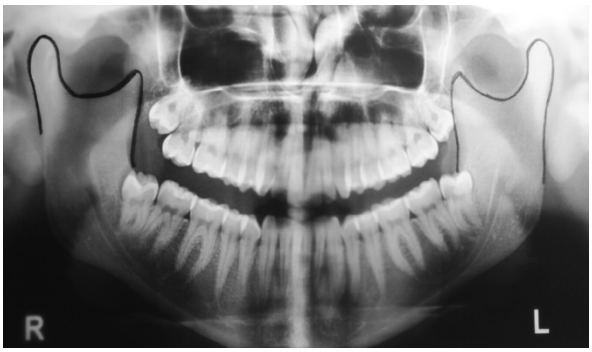
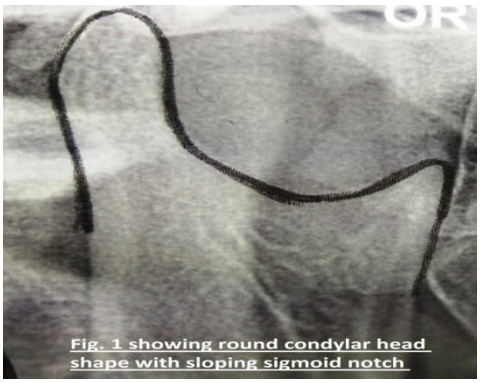
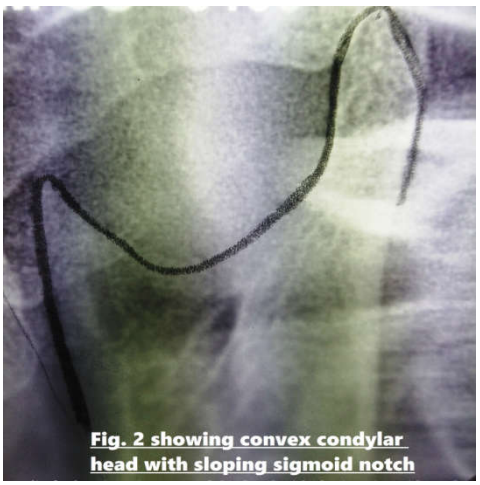
time:14s). A single observer analyzed the OPG and traced the condylar region and sigmoid notch of both the sides over trace paper by marker pencil using OPG viewer. The various shapes of condylar process and sigmoid notch were interpreted as given by Hedge *et al* [5] and Shakya *et al*.[3], repectively [Figure 1-7]. The shapes are recorded for both right and left sides and for both gender. Thus a total of 696 sides were assessed and comparison was made for right and left sides and between the gender.

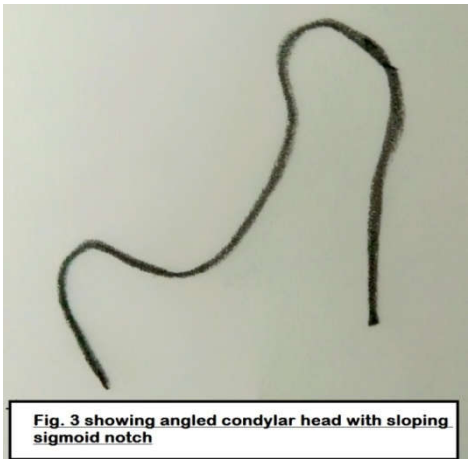


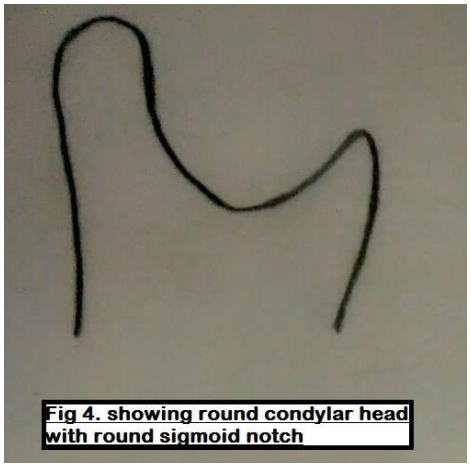
OPG Showing Round Condylar Head With Round Sigmoid Notches

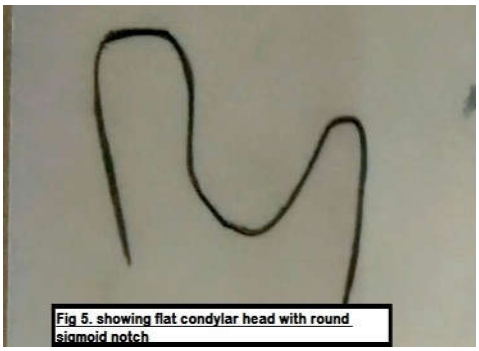
Statistical Methods: The recorded data was compiled and entered in a spreadsheet (Microsoft Excel) and then exported to data editor of SPSS Version 20.0 (SPSS Inc., Chicago, Illinois, USA). Data were summarized as frequencies. The gender-wise and sidewise distribution of sigmoid notch and condylar process shapes were tested by employing Chi-square test. A P-value of less than 0.05 was considered statistically significant.

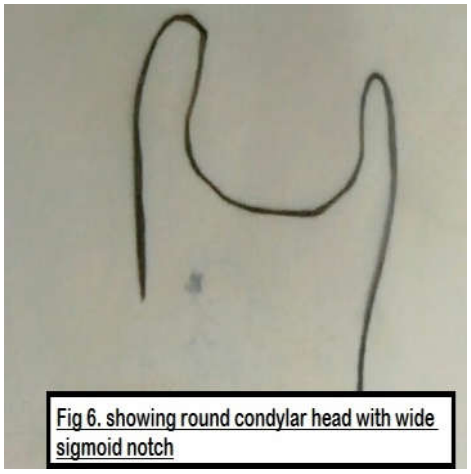












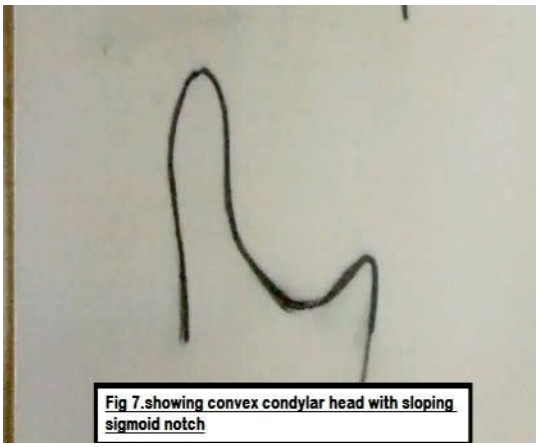


Fig 7.showing convex condylar head with sloping sigmoid notch

RESULTS

Total 348 OPGs obtained (696 sides), out of which 200 (400 sides) were of males and 148 (296 sides) were of females. The most common shape of the sigmoid notch observed was round form (440 sides), out of which 272 were present in males and 168 were in females. The second most common shape of sigmoid notch was sloping form (192 sides) out of which 86 were in males and 106 were in females followed by wide shape (64 sides), out of which 42 were in males and 22 in females. The distribution of sigmoid notch among males and females had shown statistical significant differences.

Table 1 Gender-wise distribution of sigmoid notch shapes

Gender	Wide	Sloping	Round	Total
Male	42	86	272	400
Female	22	106	168	296
Total	64	192	440	696
Chi-square= 17.78; P-value<0.001 (Statistically Significant)				

In males sidewise distribution of sigmoid notch showed 144 and 128 round form of sigmoid notches in right and left sides, respectively followed by 38 sloping form on right side and 48 on left side. The least form observed were wide form 18 on right side and 24 on left side. The distribution of sigmoid notch in males among right and left sides had shown no statistical significant differences.

In females sidewise distribution of sigmoid notch showed 81and 87 round form of sigmoid notch in right and left sides respectively followed by 58 sloping form on right side and 48 on left side. The least type of sigmoid notch observed was wide form with 09 on right side and 13 on left side. The distribution of sigmoid notch in females among right and left sides had shown no statistical significant differences.

Table 2 Sidewise distribution of sigmoid notch shapes in males and females

Shapes of sigmoid notches		Right	Left	Total	Chi-square	P-value
Males	Wide	18	24	42	2.961	0.228
	Sloping	38	48	86		
	Round	144	128	272		
Females	Wide	9	13	22	1.885	0.389
	Sloping	58	48	106		
	Round	81	87	168		

The most frequently observed condylar shape was round in 422 cases, out of which 260 were in males and 162 were in females. The angled shape was second most common shape accounting for 204 sides, with 88 in males and 116 in females followed by convex shape of 52 sides, with 36 sides in males and 16 sides in females. Flat shape was least common type which accounts for only 18 sides with 16 in females and 2 in males. The most common type in males and females was round shape of condylar process. The distribution of condylar shapes among males and females had shown statistical significance differences.

Table 3 Gender-wise distribution of condylar process shapes

Gender	Round	Angled	Convex	Flat	Total
Male	260	88	36	16	400
Female	162	116	16	2	296
Total	422	204	52	18	696
Chi-square=30.32; P-value<0.001 (Statistically Significant)					

In males sidewise distribution of condyle showed 126 and 134 round shaped on right and left sides respectively followed 46 angled on right side and 42 on left side with 18 convex type on right side and 18 on left side followed by least type of flat shape which was 10 on right side and 6 on left side. The distribution of condylar shape among right and left sides had shown no statistical significance differences.

In females the most frequently observed shape of the condyle was round (80 on the right side and 82on the left side) followed by angled (57 on the right side and 59 on the left side), convex (11 on the right side and 05 on the left side and flat shapes (0 on the right side and 2 on the left side). The distribution of condylar shape among right and left sides in femlaes had shown no statistical significance differences

Table 4 Sidewise distribution of condylar process shapes in males and females

Shapes of sigmoid notches		Right	Left	Total	Chi-square	P-value
Males	Round	126	134	260	1.43	0.699
	Angled	46	42	88		
	Convex	18	18	36		
	Flat	10	6	16		
Females	Round	80	82	162	4.31	0.231
	Angled	57	59	116		
	Convex	11	5	16		
	Flat	0	2	2		

DISCUSSION

Mandible is the strongest bone of the face and has been utilized in forensics because it remains intact in autopsy human skulls thereby paving a way to person identification[2,3,4]. Mandibular condyle is a bony ellipsoid structure connected to ramus by narrow neck. having dimensions approximately 20mm long medio-laterally and 8-10 mm thick anteroposterioly. The superior aspect of condyle may have different shapes like flattened, rounded or convex whereas mediolateral aspect is convex always. Several studies have been done to evaluate the morphology of the human condyles and coronoid process and sigmoid notch [5].

In 1961, Yale *et al*. was the first one to report about the different shapes of mandibular condyle [6]. Initially Yale classified condylar head based on superior view into three categories namely concave, convex and flat, however later on he simplified it into four categories namely convex, flattened, angled and rounded [6, 7].

A study in 1980's on mandibular condyle morphology in relation to malocclusion in children revealed that the condylar size in males was greater than in females and midline discrepancy significantly altered the increase in condylar size during growth [8].

In this study, done in kashmiri population the round form of the sigmoid notch was commonly observed followed by the sloping form and the least common form was wide. Where as in a study conducted by Sahithi *et al* the most common form was wide followed by round and sloping forms [5].

Nagaraj T *et al* conducted a study to assess the different morphological types of condylar process and sigmoid notch and their correlation with age and gender using panoramic radiographs in North Bengaluru population showed sigmoid notch shapes higher prevalence of sloping form was found followed by round form and wide form [3]. However, in our study the variation of sigmoid notch when compared on either side were not statistically significant but among gender it was statistically significant which were in contradiction to Nagaraj T *et al* and Shakya *et al* studies [9, 3].

In our study, the most common shape of condyle was round followed by angled, convex and least common type was flat shape which was in accordance with Nagaraj T *et al* study [9]. Among genders the most common type was round type in males and round type in females which were in contra diction to Sahithi *et al* study. In our study flat shape condylar process was more common in males than females which was in contradiction to Sahithi *et al* study [5].

The studies reported by Ribeiro *et al* in Brazilian population [10] and Chaudhary *et al* [11] in East Indian population, showed that round/ oval shape to be common in both the gender, which goes in accordance with our study. A study conducted by Oliveira *et al* had shown the round shape to be more frequent followed by pointed and flat shapes, which was a similar finding seen in this study [12]. The distribution of condylar shapes among gender was statistically significant and is contradictory to Nagaraj T *et al* and Sahithi *et al* studies and between right and left sides were not significant in our study which was in accordance with Nagaraj T *et al* and Sahithi *et al* studies [9, 5].

CONCLUSION

In our study pertaining to kashmiri population the most common shape of sigmoid notch was round form and condylar process with round shape. There was seen variations in shapes of sigmoid notch and condylar process among genders in this study. Larger sample sizes with different population studies are required in order to be more precise for its usage in person identification.

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How to cite this article:

Shazia Maqbool *et al*.2018, Morphological Assessment of Variations of Condylar Head And Sigmoid Notch on Orthopantomograms of Kashmiri Population. *Int J Recent Sci Res.* 9(10), pp. 29162-29165.
DOI: http://dx.doi.org/10.24327/ijrsr.2018.0910.2804

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