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THE ANALYSIS OF THE POSITIONAL RELATIONSHIP OF CONDYLOID PROCESS WITH MANDIBULAR FOSSA AND MORPHOLOGICAL CLASSIFICATION OF CONDYLAR HEAD IN T.M.J. TROUBLE PATIENTS

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INTRODUCTION

In the successful diagnosis of the TMJ disorders, the roentgenographic examinations (Oblique-lateral transcranial projection[17,38,41], Transorbital projection[39,41], Transmaxillary projection[2,23], Transpharyngeal projection[32], Infracranial projection[39,41], Orthopantomography[1,36,40,41] and Tomography[8,10,15]) play the important role by certifying the positional relationship between condyloid process and mandibular fossa, and the pathologic conditions of condylar head itself. Especially, with the oblique-lateral transcranial view, it is possible, if prepared good conditioned roentgenograms, to measure the anterior, posterior joint space of mandibular fossa and condyloid process and the positional relationship between them[3,19,30,54,55,57,58], and in the transorbital view, we can classify morphologically condylar head as well as study qualitatively its mediolateral dimension.

In the practical clinical view point, we must get a comprehensive knowledge about the anatomical condylar form, the range of variation on its form induced by the condition of the roentgenographic examination, the positional changes in TMJ relationship, and the morphological relation between the roentgenographic condylar shape of symptomatic patients and that of asymptomatic subjects.

The aims of this study consist in clarifying the positional analytic methods, in classifying morphological and positional range of condyloid process in the symptomatic patients as well as in comparing the remodelled morphological changes of condylar head due to TMJ disorders with those of asymptomatic subjects.

MATERIALS

The used materials were 174 traceable films (101 transcranial views, 73 transorbital views, and 112 total subjects) taken under the good condition, without any fracture, developmental defects, tumor, rheumatic factor, luxation and history of orthodontic treatment, which had been selected from those of 274 patients. Previous tracing of all subjects was performed for the purpose of acquiring the preliminary comprehensive information about TMJ. The age distribution in subjects ranged from 8 to 77.

The condition of the roentgenographic technique in each films was as follows: For taking transcranial view (FFD=101cm, OFD=1cm), the board was used at angle of 30°. After positioning the patient's F-H line parallel with the film margin and his midsagittal plane with the film plane and then marked the lead mark line at the area 1 cm forwards and downwards away from the external auditory meatus, the central beam was directed perpendicular to the room floor. The central beam was directed only to enter the area 1 cm forwards away from the external auditory meatus.

For taking the transorbital view (FFD=27cm), the patient was tilted at an angle of 20° to the examined area. The central beam was directed to enter the center of orbit at an angle of 20° downwards.

By tracing the films taken by the aforesaid technique, the author has tried to study the positional relationship and morphological classification of condylar head.

The films used were of maximum intercuspal position and opened position in the transcranial views, and of maximum opened position in the transorbital views.

METHODS

A. The positional relationship of condyloid process and mandibular fossa.

1. On the tracing paper of transcranial view, the basic point "A" was determined as the point where the line parallel with the patient's F-H line coincide with the deepest portion of mandibular fossa. The A_1 and A_2 were determined as those where the circle, at a diameter of 3.5mm around the center point A, meets the slope of mandibular fossa. The point "O" was determined as that where the line drawn from the point "A" perpendicular to the lead mark line meets the lead mark line. The point a_1 and a_2 were determined as those where the lines drawn from A_1 and A_2 to "O" meet the contour of condylar head.

The author compared the anterior joint space, A_1-a_1 distance, with the posterior joint space, A_2-a_2 distance.

a. If the A_1-a_1 distance is larger than the A_2-a_2 distance, then the condyloid process was considered to be at the retro-position,

b. If the A_1-a_1 distance is equal to the A_2-a_2 distance, then at the normo-position, and

c. If the A_1-a_1 distance is smaller than A_2-a_2 distance, then at the antero-position (fig.1).

The author also compared the positional changes of right condyloid process with that of left condyloid process.

a. the term "asymmetry" was used of the condylar position and corresponding joint space at both sides do not coincide with each other, and

b. the term "symmetry" was used when the condylar position and corresponding joint space at both sides coincide with each other.

Furthermore, the symmetry cases were classified into antero-positioned, retro-positioned and normo-positioned symmetries.

2. In the transcranial view of opened position, the condyloid process was classified as of hypermobility if located anterior to the articular eminence, as of hypomobility if posterior to the articular eminence. And then hypo-, and hypermobility were further classified into symmetry and asymmetry.

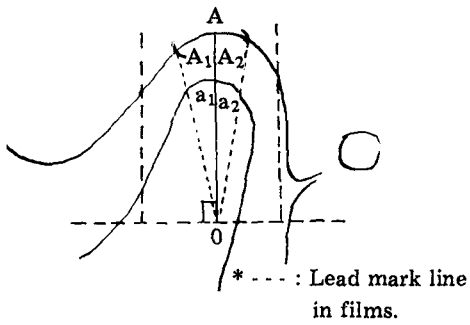

Fig. 1 The analytic method for position of condyloid process regard to TMJ space in transcranial view.

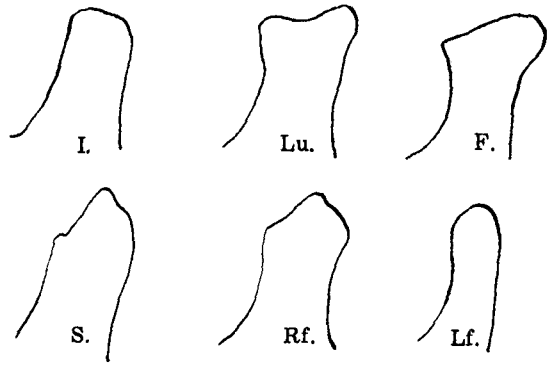

Fig. 2 The clinical classification of shape of condylar head in transcranial view of symptomatic patients.

B. Morphological classification of condylar head.

1. In the transcranial view, anteroposterior condylar contour was classified into the following 6 types (Fig.2) :

a. Index finger shape (I), when the condylar head is of index finger shape and its superior contour is convex, smooth and sloping a little forwards,

b. Lump shape (Lu), when the anterior and posterior part are of dull edge and of lump shape,

c. Flat shape (F), when the superior part is flat, and the anterosuperior line angle is sharp,

d. Spear shape (S), when the condylar head is similar to that of index finger shape but the superior part of speared shape,

e. Roof shape (Rf), when the superior surface of the head is angular and the line angle is sharp, and

f. Little finger shape (Lf), when the condylar head is similar to that of index finger but its superior contour is more round and little.

2. For the morphological classification of condylar head in the transorbital view, the author divided the form of contour of condylar head into four basic types: convex, angular, round and flat (fig.3).

The term "convex" is used when the radius of the curvature is greater than ½ the axial length, the "round" is used when the radius of the curvature is similar to ½ the axial length, the "flat", when the superior part of condylar head is flattened, and the "angular", when the superior contour of condylar head is angular and the anterior part of dull shape.

But new term "concave" is sometimes used when the superior surface of condylar head has irregularities, and other new term "malformed" is used when some morphological abnormalities are present due to various pathologic conditions. Therefore, these new term could not be included in the categories prepared for a rational classification (fig.4).

The condylar head was divided into three parts: medial part (=medial pole), central part (=superior surface), and lateral part (=lateral pole). And the medial and lateral parts of condylar head were studied, and classified into 4 basic types and indefinite type (Fig. 5).

All statistical values were shown as percentage (%).

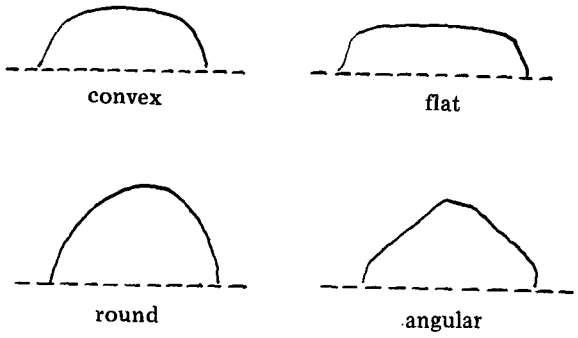

Fig. 3 Qualitative geometric definition of 4 basic type for morphological classification of condylar head in transorbital view.

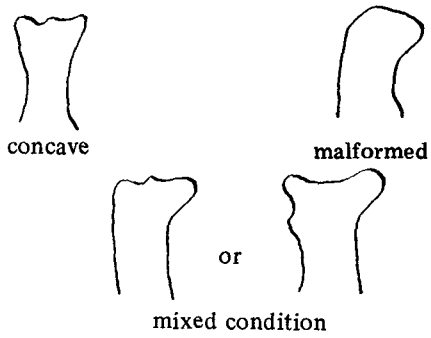

Fig. 4 The clinical classification of indefinite type, except 4 basic type of condylar head in transorbital view.

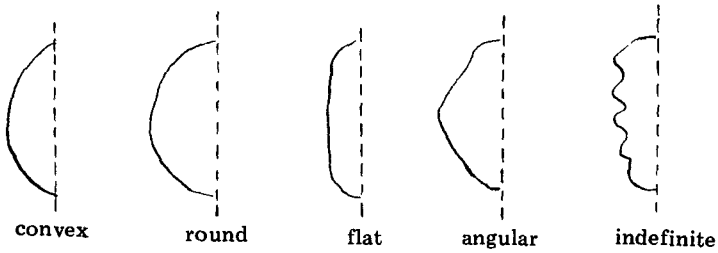

Fig. 5 The clinical classification of the shape of lateral, medial part of condylar head in transorbital view.

RESULTS

The results will be described briefly, being outlined regarding to the age distribution in the patients, the positional relationship of condyloid process to mandibular fossa and the morphological classification of condylar head in transcranial and transorbital views.

1. The age distribution in the patients was studied, being divided into 7 age groups. The whole range of age was from 8 to77. The average age was 33.2 (30.2 in male and 34.2 in female) and the ratio of the number of males and that of females was 1:3. The incidence was the highest in the age group of 21 to 30, and of 7 age groups, that of 8 to 12 was used only in age distribution in this study (table 1).

2. By studying the transcranial view,
   a. It was shown that the position of condyloid process was, in most of the cases, of retro-position on both sides. Antero-position and normo-position were distributed reciprocally

at both sides. At the right side, however, was a little dominant normo-position; at the left, antero-position (table 2).

b. It was revealed that asymmetry occurs 6.8 times as many as symmetry, and the incidence of symmetry was of 13%, of which concentricity was only of 4 % (table 3).

Table 1. Materials grouped according to sex and age.

	MALE		FEMALE	
Age	No. of Subject	%	No. of Subject	%
8–12	4		0	
13–20	3	2.7	16	14.3
21–30	13	11.6	25	22.3
31–40	5	4.5	20	17.9
41–50	6	5.4	14	12.5
51–60	0	0	5	4.5
61 over	0	0	5	4.5

Male to Female ratio; 1 to 3.

Table 2. Comparison of condylar-fossa relationship in maximum intercuspal conditon.

	Antero-position	Normo-position	Retro-position
Right	22 (21.8)	32 (31.7)	47 (46.5)
Left	35 (34.7)	26 (25.7)	40 (39.6)

Table 3. Comparison of TMJ relationship of both condyloid process in maximum intercuspal condition.

		No. of subject (%)
Asymmetry		88 (87.1)
Symmetry	Antero-positioned	5 (5.0)
	Concentricity *	4 (4.0)
	Retro-positioned	4 (4.0)

* The term "concentricity" is used when the anterior, and posterior joint space at the right side and that at the left are of equidistance.

c. By comparing the positional relation of condyloid process with articular eminence, it was shown that hypermobility were more dominant than hypomobility at both sides (table 4-1). In the maximum opened position, symmetry was present 2.6 times as many as asymmetry.

The occasion, where condyloid process is located rightly on the articular eminence, was only of 2%, and that where condyloid process was of no mobility, was of 3%. According to the obtained datas, the cases of condylar deflection were of 28% (table 4-2).

d. The frequency of appearance of each condylar forms were of following orders: index finger shape, little finger shape, lump shape, roof shape and flat shape. More than 3/4 was of index finger shape. The lump shape and little finger shape were observed more at the left side than at the right side (table 5).

Table 4-1. Comparison of position of condyloid process with regard to articular eminence in maximum opened condition.

	Hypermobility	In articular eminence	Hypomobility
Right	53(52.5)	12(11.9)	36(35.6)
Left	50(49.5)	11(10.9)	35(34.7)

Table 4-2. Comparison of positional changes of TMJ relationship of both condyloid process in maximum opened condition.

Asymmetry		28(27.7)
Symmetry	Hypermobility	44(43.6)
	Tip to tip	2(2.0)
	Hypomobility	24(23.8)
	No-movement	3(3.0)

Table 5. Comparison of morphology of condylar head with its shape, in totally and generally, in transcranial view of symptomatic patients.

	Right	Left	Mean of %
Index finger	78(72.2)	70(69.3)	73.2
Lump	7(6.9)	10(9.9)	8.4
Little finger	5(5.0)	14(13.7)	9.4
Flat	2(2.0)	3(3.0)	2.5
Roof	7(6.9)	3(3.0)	5.0
Spear	2(2.0)	1(1.0)	1.5

3. a. In the morphological classification of condylar head on the transorbital view, the combinations four basic types were 87.6%, and indefinite type was of 12.4% and their frequency was of following order: convex, angular, indefinite, flat and round. In the comparison at the both sides, with respect to the basic types, convex shape was predominant at the right side and angular shape was so at the left side, indefinite shape was observed more at the left side than the right (table 6).

b. By studying the positional relation of the uppermost portion of condylar head in the transorbital view, the occasion, where the tip is located in the central part at both sides, was of 4/5 and the occasion, where the tip is located in the medial part, was predominantly observed at the right side, more than two times as many as the left (table 7).

c. The study of the morphological classification of condylar head in the transorbital view, all the condylar forms at the medial part belonged to four basic types and the frequency was of following order: convex, angular, round and flat. The distribution showed similar pattern at both sides. The morphological classification at the lateral part included, besides four basic types, two cases of indefinite types. In the comparison between both sides, convex shape was predominant at the right side, angular shape in lateral part, however, showed higher percentage at the left. The distribution of other types showed similar pattern at both sides. The morphological comparison between medial and lateral parts revealed a similar pattern in order at both sides. At the left side, however, round and angular shapes were present in order reciprocal to the right and flat shape show more numerical value at the lateral part than at the medial (table 8).

Table 6. Comparison of classified morphology of condylar head with its shape in transorbital view.

	Right	Left	Mean of %
Convex	42(57.5)	35(47.9)	52.7
Round	6(8.2)	5(6.8)	7.5
Flat	7(9.6)	7(9.6)	9.6
Angular	10(13.7)	16(21.9)	17.8
Indefinite			
1. concave	3(4.1)	5(6.8)	5.5
2. malformed	4(5.5)	4(5.5)	5.5
3. mixed condition	1(1.4)	1(1.4)	1.4

Table 7. Comparison of classified condylar head with location of uppermost superior portion of condylar head in transorbital view.

	Right	Left
Medial	9(12.3)	4(5.5)
Central	56(76.7)	61(83.6)
Lateral	8(11.0)	8(11.0)

Table 8. Comparison of classified condylar head with the shape of lateral part and medial part of condylar head in transorbital view.

	Medial part		Lateral part	
	Right	Left	Right	Left
Convex	34(46.6)	34(46.6)	41(56.2)	31(42.5)
Round	17(23.3)	16(21.9)	15(20.5)	16(21.9)
Flat	2(2.7)	5(6.8)	6(8.2)	8(11.0)
Angular	20(27.4)	18(24.7)	10(13.7)	17(23.3)
Indefinite	0	0	1(1.4)	1(1.4)

DISCUSSION

A. Analytic Methods of Positional Relationship Between Condyloid process and Mandibular Fossa.

There have not been many studies on this subjects, but the analytic methods, which have been generally adopted, are as follows:

1. Simply to compare the deepest portion of mandibular fossa and the most superior portion of condylar head, or to compare the anterior joint space and posterior joint space without predisposing any conditions[46].

2. To analyze in respect to the arbitrary basic point which is determined as that where mandibular fossa meets the line perpendicular to the line drawn from the reference line to pterygoid fissure and articular eminence[19,57,58].

3. To analyze the position of condyloid process by measuring angles and lengths in respect to an arbitrary point in mandibular fossa which is irrelative to condyloid process [42,54].

The former two methods seem able to be applied in normal subjects and in the cases where there is no remodelling, the 1st and 2nd methods, however, bear some difficulties for detecting the position of condyloid process in symptomatic patients due to the changes to TMJ space induced by morphological abnormalities and pathologic entities. But the 3rd method is considered to be capable of adopted for the qualitative and quantitative analysis, because it is conducted by referring to an arbitrary point which is not influenced by the position of condyloid process, and because it is not influenced by the variation in the morphology of condylar head, articular eminence and so on. But above all, the author attributed it as the most important factor that films were traceable and should have been taken under the favorable condition.

In this study, the third method was adopted, referring the arbitrary point to the superior slope of fossa locating at the area 3.5mm anteriorly and posteriorly away from the basic point "A". The point A, A_1 and A_2 are generally used at the basic points for this analysis, because they are easily detected, maintain relatively stable contour [20], and symmetry[42,43,44].

B. Factor Influencing Upon the Classification of Morphology of Condylar head and Positional Relationship of Condyloid process and Mandibular Fossa.

In the classification of morphology and positional relationship, the analytic procedure is considerably interfered by image distortion that is induced by roentgenographic technique, methods of positional analysis, characteristics of condylar morphology or morphological variation, and remodelling of condylar head and temporal components.

There have been many comprehensive studies on the interfering factors which are brought about by roentgenographic technique, exposure data, variation in the taking conditions and positional analytic methods.

The analysis is generally performed three dimensionally: for anteroposterior dimension by transcranial and transpharyngeal methods which clarify the positional relationship between condyloid process and mandibular fossa, and clarify the form of condylar head; for mediolateral dimension, transorbital and transmaxillary methods; for all dimension, horizontal angulation of condylar head, infracranial methods.

Now we consider for a moment about the distorting factors which are caused by the condylar head itself. Image is considered to be a profile view of composite image [46], so it may be said that the image can be changed by the superior contour and the location of the most superior portion of the dry skull used for study as well as the fixation angle of the object and shape of remodelling. When the vertical angulation of condylar head is not especially large and the fixation angle of the patients is not especially large in relation to the patient's midsagittal plane, then the lateral 1/3 portion of condylar head seems to determine the image of its superior contour [4,17,43, 46,47]. And as one of the other image distorting factors, the variation on the horizontal angulation can be pointed out. The degree of image distortion seems to be clarified by the presence of radiopaque band[50], which appears when the horizontal angulation coincide with the direction of the

central beam. Furthermore, various external condition are also considered to result in image distortions: entry point of the central beam, horizontal and vertical angulation, fixation angle of the subjects and the relation of the beam direction to the reference line (F-H line and Ala-Tragus line). In TMJ roentgenograms, entry point and direction of the central beam are pointed out as important image distorting factors [3,4,6,9,15,16,22,24,28,38,39,41,42,45,50].

C. Morphological Classification of Shape of Condylar head.

In the transcranial views, Takaku[29] classified the shape of condylar head into three types in normal subjects and into three types in pathologic conditions. In the lateral views of anatomical shape of condylar head, Kaburaki[13,14] classified its morphology into four types in respect to its process form, into three types in respect to the tip position and twelve types by again combining these criteria, Ueda[35] classified it into five types with regards to superior contour of condylar head. Their classification methods seem not to be very divergent from those of the author.

In the transorbital view in which can be examined condylar head to the anteroposterior direction, Takaku[29] classified the shape of condylar head into three types in normal subjects and into three types in symptomatic patients.

Many studies on the posterior aspect of anatomical condylar head have been done by Yale's reports [51,52,53]. Their common methodology is to classify it by the contour of its superior surface into four basic types: convex, round, angular and flat. The author modified this classification method considering to the films of symptomatic patients, divided into five types by adding to these basic types, indefinite-remodelled or malformed. The classification was conducted on the superior surface, medial and lateral parts and most superior portion by referring to the mediolateral axis, considering that the views were of symptomatic patients.

Considerable difference between the morphology of anatomic condylar head and that examined in the transcranial views exist. Since on the dry skull the contour is determined by the most superior portion of the condylar head because the classification is performed by positioning the mandible on the table. On the other hand in the transcranial view, the contour is determined by the lateral 1/3 portion of the condylar head because there are inevitable variations in vertical and horizontal angulation for directing the central beam to pass freely along the complicated bony structure. The transorbital view also expose the posterior aspect of condylar head to some extent, hence, different it from that on the dry skull because of the same reason above.

D. Variations on the Morphology of Condylar Head Following Aging.

The roentgenographic contour of condylar head is no other than the shadow of subchondral bone contour[20], so the variation in image may explain relation of the degree of bony mineralization of condylar head[31]. The morphological development of condylar head in the anteroposterior and mediolateral dimension is reported to be completed at the stage of eruption of the lateral incisor[14] or at the late mixed dentition stage or immediately after the formation of permanent dentition[30,49]. But some studies, conducted on the macroradiography of growth, report that the

compact bone layer of fossa and tubercle is formed during the early stage[12], while the continuous bony layer of of condylar head, in peripheral portion, is not completely formed before the age of 20 years, because the condylar head is composed of calcified cartilage, and that the aging process also bring about some variations in the property of pathologic entities and the remodelling patterns.

For the successful morphological classification of the condylar head, the subjects may be selected from the age groups of more than 20 years in whom the compact bony layer is completely formed, but in the actual study by tracing on the positional relation and on the morphological, the author include the age group after the age of 13 years in whom the condylar head bears adult like contour[20] and supposed that its morphological classification is possible by the appearance of calcified cartilage.

In regards to the relation of the TMJ pathology to age and sex, it is the general theory that after the age of 40 years, osteoarthrosis is predominant, while during the age of 21 to 30, the so called pain dysfunction syndrome is more predominant[26,33,34,55]. It is reported that female is more sensitive to TMJ disorders than male.

E. Variation in the Morphology of Condylar Head Following Remodelling.

Moffett[20] and Blackwood [5] reported that this changes occur due to the distribution of mechanical stress and classified it into three types: progressive type occuring mainly in the anterior part of condylar head, in the medial part of tubercle and in the roof of fossa, regressive type occuring mainly in the posterior part of condylar head and in the lateral part of tubercle, and peripheral type.

You[55] and Chung[56] have been made categorised the clinical symptoms of patients, and clarified the abnormal radiographic findings such as flattening, concavity, loss of bone density, protuberant and hyperplasia. Uemura[37] analyzed the morphological changes of condylar head and articular eminence from roentgenodiagnostic point of view and discussed the definition of abnormal radiographic findings - eburnation, sclerosis, bone erosion, concavity, deformity, flattening, marginal proliferation and loss of bone density and so forth. This aforesaid findings suggest that remodelling as of flat, lump and roof shape.

Carlsson[7], Oberg[21], Lindvall[18], and others[15,20,29] reported that gross changes occur mainly in anterior part of condylar head, in the lateral part of condylar head and in the mandibular fossa. According to the report by Toller[33], in osteoarthrosis, the remodelling occurs also at the site of functional stress. Thereofre, in the transcranial view at the angle of 15-30°, the site of composite image is considered to be where the remodelling processes or pathologic changes occur. The data in this study indicates that the morphological variations are found more clearly in the lateral part than in the medial.

F. Positional Relationship Between Non Trouble Subjects and Symptomatic Patients.

In the transcranial view, Weinberg[42] defined the concentricity in bilateral symmetry as the normal, and positional variation such as asymmetry, protrusive symmetry, retrusive symmetry and so on as the abnormal[11]. Petersson[24], however, reported that the informations in

transcranial view are not reliable for studying the positional relationship of condyloid process to temporal components in the intercuspal position, Wilkie[47] analyzed the films in non trouble subjects taken by Weinberg's method, classifying that into maximum intercuspitation, centric relation and muscular stimulation, and concluded that in maximum intercuspitation as well as in centric relation, central position was of 80%, and that in muscular stimulation, antero-position was of 50% and central position, of 50%.

There are reported some data which are incompatible to some extent with those obtained by analyses of the significances and information in the transcranial views[23,25,35]. In the transcranial views, excessive hypermobility of condyloid process in the maximum opened position is considered to be one of the main symptom of TMJ troubles, but hypermobility is not generally considered to be of abnormal or pathologic condition[19,27,48]. Wooten[48] reported by analyzing the transcranial views in symptomatic patients, that hypermobility occupied about 80%, and 60% in both side and tip to tip relation only 8%.

In the present study, the datas indicate that hypermobility is of about 44%, at both sides, that the condylar deflection in opened position at both sides is of about 28%, and that retro-position in intercuspal position were more dominant than any other position as reported Popa's[25] results.

G. The comparison of the morphology of condylar head in the symptomatic patients with that of dry skull is very difficult, the comparison with the datas of previous researches[51,52], however, indicate, in the posterior and superior surface, the appearance of four basic types are found to be decreased by 10% and that indefinite types occupy about 7%.

The author suppose that it is necessary that the morphological classification and positional relationship be studied the films taken under constant roentgenographic condition. But this study was performed in the transcranial and transorbital views in symptomatic patients taken under variable condition. Furthermore, the author regards the "reproducible" roentgenographic technique as the necessary condition for more favorable comparative study.

SUMMARY

A morphological and positional classification was undertaken in the transcranial and transorbital views of 174 traceable films which had been selected from those of 274 patients and previous tracing was performed. For the positional analysis, the author adopted the method which is not influenced by TMJ remodelling, and for the morphological classification, made progress the general method by adding indefinite type to four basic types.

The aims of this study consists in performing positional and morphological analysis of condylar head and in its morphological and positional variation in symptomatic patients.

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顎關節 機能障碍 患者에 있어서 關節突起의 位置的 關係 및 그 形態에 關한 放射線學的 硏究

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》국 문 초 록《

악관절 기능장애 환자를 성공적으로 진단 함에 있어서, 악관절 X선 사진은 그 X선 검사 개개의 이용목적에 따라 변하는 요소를 지니고 있으나 보편적이며 제한된 2종류의 악관절 촬영 술식을 이용하여, 악관절부의 하악와와 관절돌기의 위치적 상관관계 및 해부학적 관절돌기의 방사선학적 형태와 그 형태이상의 비교 검토가 행하여 질 수 있다. 즉 transcranial view에서는 악관절부의 전후 폭경과 위치적 관계 및 이상형태를, transorbital view에서는 관절돌기의 형태학적 분류 및 내외측 관계의 정성적 관찰이 가능하다.

이에 저자는 악관절 기능장애 환자의 X선 사진중 본논문에 합목적적으로 사용될 수 있다고 사려되는 274예를 대상으로 예비 묘사하여 개괄적인 지식을 얻은후, 악관절 X선사진 174매를 사용하여 관절돌기의 위치적 관계 및 형태를 분석하여 다음과 같은 결론을 얻었다.

1. 환자의 평균년령은 33.2세이고, 최빈발 연령층은 20-30세 군이었으며 남녀의 비는 1 : 3이었다.

2. Transcranial view에서

ㄱ) 관절돌기의 위치는 후방위가 가장 많았으며, 전방위와 중심위에서는 좌우측이 상반되는 결과를 나타냈다.

ㄴ) 좌우측의 위치적 관계는 비대칭이 대칭적관계의 6.8배의 수치를 보였으며, 대칭적 관계가 13%이며, 그중 concentricity는 4%에 불과하다.

ㄷ) 관절돌기의 운동상태는 과다운동성, 과소운동성, 정점 대 정점의 순이었다.

ㄹ) 관절돌기의 형태는 지시지형(指示指型)이 전체의 75%이상이었다.

3. Transorbital view에서

ㄱ) 관절돌기의 형태는 돌출형, 각형, 원형, 편평형의 순이었으며, 이 기본형이 87.6%, 부정형이 12.4%를 점유했다.

ㄴ) 관절돌기의 최상부의 위치는 중심부에 위치한 것이 약 80%이었다.

ㄷ) 관절돌기의 내측단은 4기본형에 속했으며, 외측단은 4기본형 외에 1.4%의 부정형을 나타냈다.