치의학박사 학위논문

Radiographic feature of cleidocranial Dysplasia on panoramic radiograph

쇄골두개형성이상 환자의 파노라마방사선영상에서 관찰되는 치아 및 악골의 방사선학적 특성

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Radiographic features of cleidocranial dysplasia on panoramic radiograph

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Objectives

The aim of this study was to identify the imaging features of cleidocranial dysplasia on panoramic radiograph.

Materials and Methods

A total of 40 panoramic radiographs from 40 patients were selected from 43 patients with cleidocranial dysplasia. This study was a cross sectional study on the patients diagnosed with cleidocranial dysplasia in the Seoul National University Dental Hospital. The clinical and radiographic records of patients diagnosed with cleidocranial dysplasia between 2004-2018 were assessed using electronic dental record and picture archiving and communications system (PACS; Infinitt Healthcare Co., Seoul, Korea). Inclusion criteria were only the Korean patients with quality of panoramic images that mean those panoramic images should be all feature appeared, and

corrected standard position. Exclusion criteria were the patients with post-operative or post-orthodontic treatment those with poor quality of panoramic images, this study 3 patients with post-operative were excluded. The panoramic radiograph which was taken at first was included if a patient took radiographs more than once. The following characteristics in each image were assessed; 1) number of supernumerary teeth, 2) number of impaction teeth, 3) shape of ascending ramus (presence of parallelism), 4) size of maxillary sinus (present of small size or who had not maxillary sinus), 5) shape of mandibular midline suture, 6) shape of mandibular angle, 7) shape of mandibular condyle, 8) shape of coronoid process, 9) shape of sigmoid notch, 10) shape of antegonial notch, and 11) shape of hard palate. Third molars were excluded from the enumeration of teeth in this study.

Results

The number of supernumerary teeth according to the age group and sex at each region. The mean number of supernumerary teeth per person were 6.4 in males, 5.5 in females, and 6.1 in total. Also, they were 4.4 in 1-10 years, 7.6 in 11-20 years, 4.8 in 21-30 years, 8.7 in 31-40, and 7.3 in over 40 years group, respectively. The greatest number of supernumerary teeth was 17 found in a patient, followed by 14, 11, and 10 found in 2 patients, 9 in 4 patients, 8 in a patient, 7 in 6 patients, 6 in 4 patients, 5 in a patient, 4 in 3 patients, 3 in 4 patients, 2 in 4 patients, and 1 in a patient. There were 5 patients who had not supernumerary teeth, one male and four females. But more than 1

supernumerary tooth per normal tooth was never observed. The mean numbers of supernumerary teeth per person were 0.9 in the anterior, 0.8 in the right premolar, 0.9 in the left premolar, 0.2 in the right molar, and 0.2 in the left molar of maxilla, respectively. Also, they were 0.8 in the anterior, 1.0 in the right premolar, 0.9 in the left premolar, 0.2 in the right molar, and 0.1 in the left molar region on mandible, respectively.

Regarding the impacted teeth, the mean number of impacted teeth per patient was 8.3, ranging from 0 to 19 in maxilla. The number of impacted teeth on maxilla showed in anterior region, followed by premolar, and molar region. The anterior region, right premolar, right molar, and left molar no statistical significance different between sexes and age group ($p>0.05$). There was statistical significance different between only sexes in left premolar region ($p<0.05$). In mandible, the greatest number of impacted teeth showed in anterior region, followed by premolar region, and molar region. The anterior region, left premolar, right molar, and left molar region no statistical significance different between sexes and age group ($p>0.05$). There was only right premolar region was statistical significance different between age group ($p<0.05$).

The shape of ascending ramus was related founded 32 in the total. But there was no statistical significance different between sexes and age group ($p>0.05$).

The shape of maxillary sinus small size was related with cleidocranial dysplasia patient in this study but, there were no statistical significance between sexes and age group ($p> 0.05$). The shape of mandibular midline suture not

related founded only 5 patients. The angle of mandibular most founded on the 110.00˚-120.00˚, followed by 120.01˚-130.00˚, 130.01˚-140.00˚ and last one over 140˚, there were no statical significance different between both side with sexes and age group were no statical significance (p>0.05).

The shape of mandibular condyle, in case of male most founded with rounded shape, followed by convex, flattened, and angle shape, in female most found was rounded shape, followed by convex, angle, but not found in flattened shape. The shape of the coronoid process, in case of male most founded with triangular shape, followed by rounded, beak and flattened shape, in female most found was rounded shape, followed by triangular, and flattened shape, but not found in beak shape.

The shape of sigmoid notch in male and female no deferent most founded was rounded shape, followed by wide shape and sloping shape.

The shape of antegonial notch, in case of male most founded was asymmetrical posterior notch, followed by asymmetrical anterior notch and symmetrical notch. In case of female most found was asymmetrical posterior notch, followed by symmetrical notch, and asymmetrical anterior notch. There were no statistically significant differences between the right and left side according to the sexes and age group (p>0.05).

The shape of hard palate, in case of male most founded was wide angle w shape, followed by w, straight, convex, v shape and wide-angle v shape, concave shape founded only one case, in case of female was w shape, followed

by wide angle w, wide angle v, convex, straight, and v shape, not found in concave shape.

Conclusion

Panoramic radiograph was valuable to identified the feature of cleidocranial dysplasia and to confirm the diagnosis. The results this study was in agreement with those of other studies in feature of dental and maxillofacial radiography in patient with cleidocranial dysplasia in literature, such as number of supernumerary teeth, impaction teeth, shape of ascending ramus, small shape of maxillary sinus should be considered in patients with cleidocranial dysplasia. In the future study, advanced imaging modality such as cone-beam computed tomography would provide more features and information on the teeth and jaw bone of the patients with cleidocranial dysplasia.

Key Words: Cleidocranial Dysplasia; Panoramic Radiography; Tooth; Maxilla; Mandible; Hard Palate;

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ABBREVIATION

PACS	Picture Archiving and Communications System
Eru.t	Erupted Tooth
Imp.t	Impacted Tooth
Sup.t	Supernumerary Tooth
Nsp.t	Number of supernumerary teeth
IGo	Inferior gonion
ACP	Anterior convexity point
Go	Gonion
N	Number
Rt.	Right
Lt.	Left
M	Male
F	Female
T	Total

INTRODUCTION

Cleidocranial dysplasia is an autosomal dominant rare skeletal dysplasia characterized by hypoplastic clavicles, skull, jaws, delayed closer of fontanelles, and moderately short stature [1,2]. Cleidocranial dysplasia is inherited as an autosomal dominant trait, with generation-to-generation transmission [3]. However, several clinical studies showed that cleidocranial dysplasia is a generalized skeletal disorder, that effects not only the clavicle and skull, but also the entire skeleton. The general health of patients with cleidocranial dysplasia is usually good and there is no intellectual impairment [4]. Whereas the worldwide prevalence of cleidocranial dysplasia is generally regarded as being about 1 per million. Hyperdontia is one of the major dental features of cleidocranial dysplasia, and this anomaly can involve either, or both the primary and secondary dentition in patients with cleidocranial dysplasia. Hyperdontia can lead to dental impaction, overcrowding, and malocclusion, while midfacial hypoplasia can exacerbate these problems [5]. Other dental abnormalities in cleidocranial dysplasia include delayed eruption and retention of primary and secondary dentition, multiple supernumerary teeth, abnormal crowns of the teeth such as hypoplastic enamel. Also, dentigerous cysts and taurodontia are frequent finding [6-8]. In younger age group, spacing of the lower incisors, supernumerary tooth buds, and parallel-side rami are consistent manifestation [9]. Supernumerary teeth are usually located in the anterior and premolar regions [7,10,11]. The patients with cleidocranial dysplasia are short

in stature, the face is small and sometimes asymmetrical, because the disease affects the growth of jaws and cheekbones. Hearing loss has been described in only a few cases [12,13]. Maxilla may be characterized by reduced anterior and posterior height; in addition, the zygomatic bone is hypoplastic in most cases. Palate has in many cases been described as high, narrow and strongly arched [24]. Radiographically, Jensen and Kreiborg [6] have reported that the ascending ramus was parallel-sided and the coronoid process pointed with a distal curvature compared with normal presentations. Also, Maxillary sinuses may be absent or reduced in size which may be associated with alterations in the shape of the hard palate. In mandible, Furuuchi et al. [14] described that the ascending ramus showed parallel between the anterior and posterior borders of ascending ramus, and the coronoid process pointed upwards and/or posteriorly. Besides, there have been studied on the classification of the shape of mandible including the shape of mandibular condyle, coronoid process, sigmoid notch, mandibular angle, antegnoial notch. Nagaraj et al.'s study [15] defined the morphological shapes of coronoid process, condyle, and sigmoid notch on panoramic radiographs of the population in North Bengaluru. They showed that the most common shapes of coronoid process and sigmoid notch were triangular and wider from, respectively. Also, the most common shape of mandibular condyle was angled in males and round shapes in females, respectively. Shakya et al. in 2013 [16] described three shapes (sloping, wide, and round shape) of the sigmoid notch and 4 shapes (round, beak, triangular, and flatted) for coronoid process. Sahithi et al. in 2016 [17] also divided the

condylar shape into round, angled, convex, and flat, sigmoid notch into round, sloping and wide, and coronoid process into triangular, round, beak, and flat shapes. Duta et al. in 2004 [18] described the measurements of antegonial angle, antegonial depth and gonial angle in edentulous and dentate patients.

Regarding the shape of hard palate, Demante et al. in 1998 [19], described 7 shapes of palate such as w shape, wide angle w, v, wide angle v, convex arc, concave arc, and straight shape.

The characteristic facial features of cleidocranial dysplasia patients include brachycephalic head, hypertelorism with exophthalmia, depressed nasal bridge, small maxilla, and mandibular prognathism was seen [20].

Panoramic radiograph is one of the most common extraoral techniques which provide a precise view of the maxillomandibular area presenting a unique of both upper and lower dental arches. Other advantages include a lower radiation intake for patients and a relatively shorter imaging time. Also, convenient used include in the development country.

The objective of the present study was performed to describe the imaging features of cleidocranial dysplasia on panoramic radiographs only.

MATERIALS AND METHODS

The study was approved by the Institutional Review Board (IRB) of Seoul National University Dental Hospital (ERI18001). The panoramic radiographs were collected retrospectively after removing identifiable patient information. The data collection was performed in accordance with the relevant guidelines and regulations. This study was a cross sectional study on patients diagnosed with cleidocranial dysplasia in the Seoul National University Dental Hospital. The clinical and radiographic records of patients diagnosed with cleidocranial dysplasia between 2004-2018 were selected using electronic dental record and picture archiving and communications system (PACS; Infinitt Healthcare Co., Seoul, Korea). Inclusion criteria were the Korean patients only with quality of panoramic images, that mean those panoramic images should be appearance of all anatomical feature, and corrected standard position. The image quality of panoramic radiographs was assessed by an oral and maxillofacial radiologist. Exclusion criteria were the patients with post-operative or post-orthodontic treatment and the patients with poor quality of panoramic images. There were only 3 patients with post-operative and orthodontic treatment, and they were excluded. Finally, a total of 40 panoramic radiographs from 40 patients were selected from 43 patients with cleidocranial dysplasia. The panoramic radiograph which was taken at first was included if a patient took radiographs

more than once.

The following characteristics in each image were assessed; 1) number of supernumerary teeth, 2) number of impacted teeth, 3) shape of ascending ramus, 4) size of maxillary sinus, 5) shape of mandibular midline suture, 6) shape of mandibular angle, 7) shape of mandibular condyle, 8) shape of coronoid process, 9) shape of sigmoid notch, 10) shape of antegonial notch, and 11) shape of hard palate. Third molars were excluded from the enumeration of teeth in this study. Each feature was investigated according to the sex and age group. The feature was decided.

1. Number of supernumerary teeth

The number of supernumerary teeth was investigated in 3 regions such as anterior, premolar, and of molar regions, of maxilla and mandible. Anterior region was defined from the center line between canine and first premolar of the right side to that of the left side, premolar region from the center line between canine and first premolar to the center line between second premolar and molar, and molar region from the center line between second premolar and molar to the center line between second molar and third molar. When the supernumerary tooth positioned on the separate line, the position was determined in the region including more than half tooth (Figure 1). First, the number of patients according to the number of supernumerary teeth were investigated. Second, the total number of supernumerary teeth in all patients were investigated, and analyzed separate according to the sex and age group, and region. In addition, the mean number of them per person was calculated.

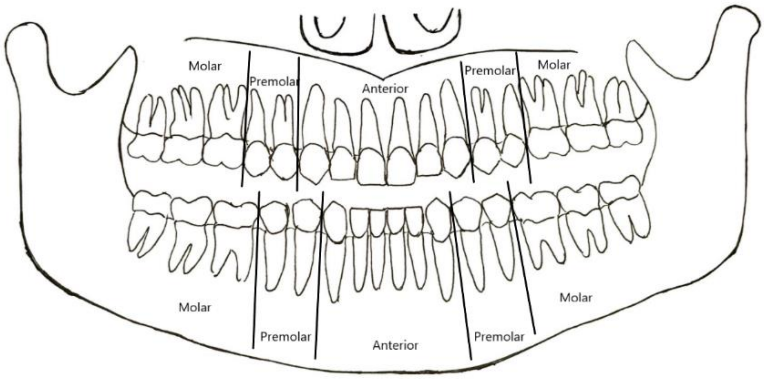

Figure 1. Jaw bone is divided into 3 regions such as the anterior, premolar, and molar region to count the number of supernumerary and impacted teeth on maxilla and mandible.

2. Number of impacted teeth

The impacted teeth were considered only in normal dentition including primary and permanent teeth, that is, impacted supernumerary teeth were not included in this data, but in the supernumerary teeth. The teeth of normal dentition were differentiated from supernumerary teeth considering the tooth size, shape, and position. The number of impacted teeth was counted in the 3 regions such as anterior region (central and lateral incisor counted from aged 10 years, and canine from 14 years old), premolar (counted from 14 years old), and molar regions (first molar counted from 9 years, and second molar from 14 years old) (Figure 1). The total number of impacted teeth in all patients were counted, and analyzed separate according to the sex and age group, and region.

3. Shape of ascending ramus

The shape of ascending ramus was assessed on each patient's panoramic radiograph. Ascending ramus was divided into parallel or normal shape. The parallel shape of ascending ramus was decided when the ramus showed total of almost parallel borders between the anterior and posterior border of mandibular ramus. After separate the total parallel and normal shape was also investigated for finding of deferent between male and female, and between in age group.

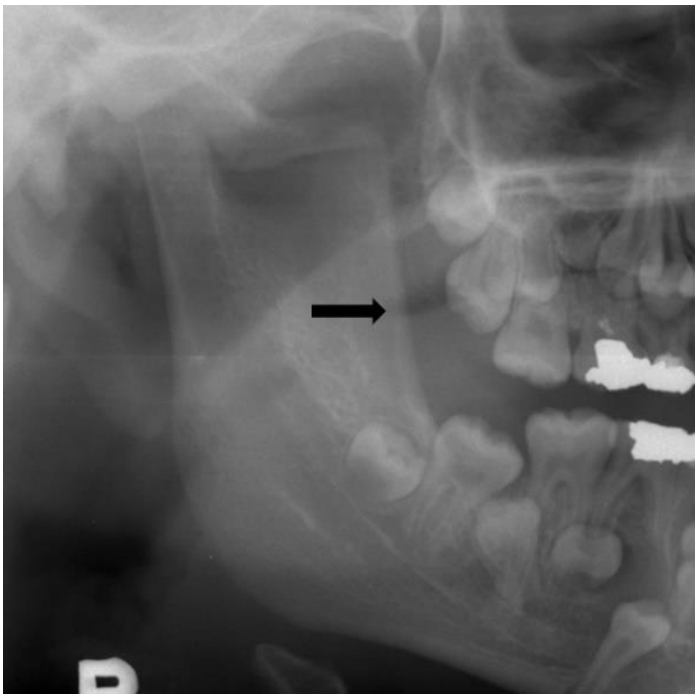

Figure 2. The anterior and poster ascending ramus is near parallel.

4. Size of maxillary sinus

The patient's maxillary sinus was divided into small or normal size. Undetected sinus was regarded as a small maxillary sinus. The decision was performed on the right and left side, respectively, according to the sex and age group.

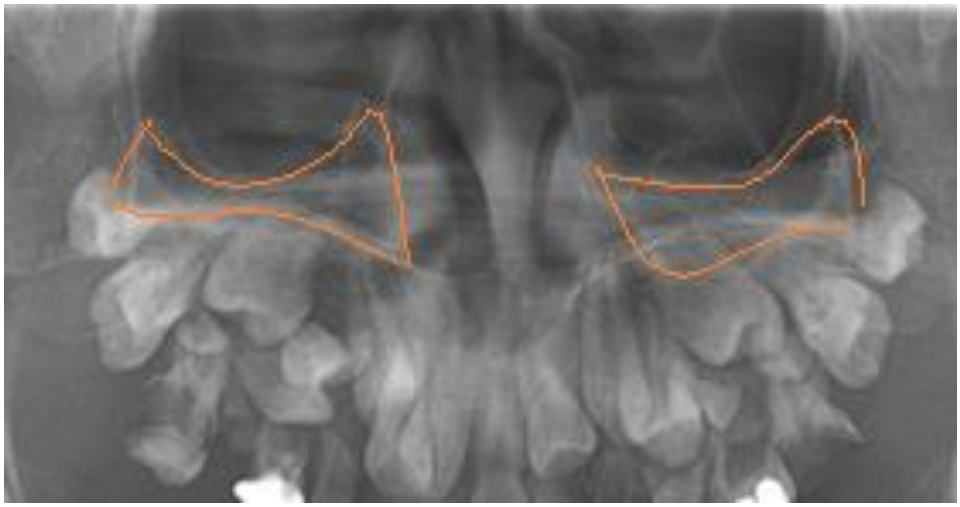

Figure 3. An example of small maxillary sinus.

5. Presence or absence of mandibular midline suture

Patients' mandibular midline sutures were assessed. When the mandibular suture was found, it was regarded as "presence" of mandibular midline suture, and as "absence" when not found. The number of patients of presence or absence of mandibular suture was analyzed according to the sex and age group.

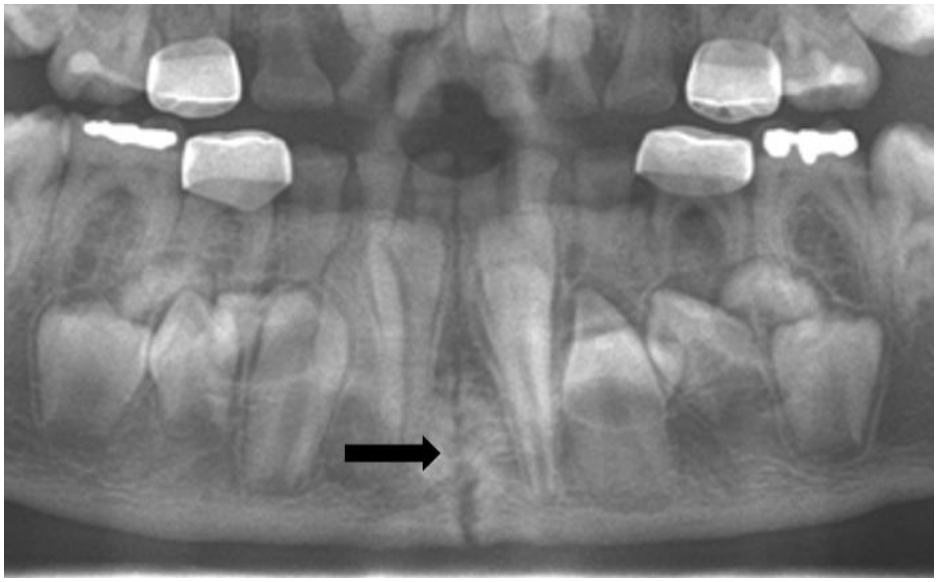

Figure 4. An example of mandibular midline suture.

6. Mandibular angle

The mandibular angle of each patient was measured using a protractor drawing a tangential line to the lower border of the mandible and to the posterior border of the ramus and the condyle, the intersection of these two lines formed the gonial angle. The angle was divided into 4 group such as 100.00˚~ 120.00˚, 120.01˚~ 130.00˚, 130.01˚ ~ 140.00˚, and over 140˚.

Figure 5. Measurement of mandibular angle.

7. Shape of mandibular condyle

The shape of mandibular condyle of each patient was classified into 4 types such as round, angle, convex, and flattened shape according to the Nagaraj et al' study (Figure 6) [15]. The shape of mandibular condyle was classified according to the sex and age groups.

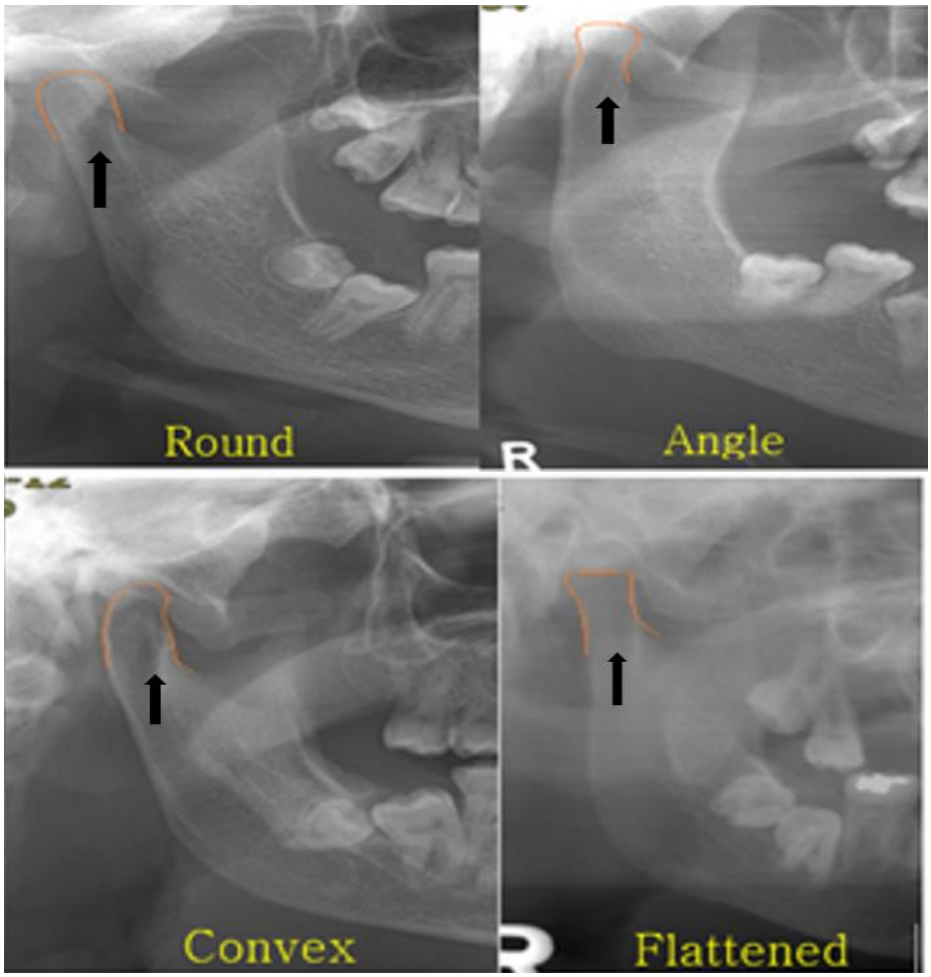

Figure 6. Classification of the shape of mandibular condyle.

8. Shape of coronoid process

The shape of coronoid process of each patient was classified into 4 types such as rounded, triangular, beak, and flattened according to the Furuuchi et al' study (Figure 7) [14]. The shape of coronoid process was classified according to the sex and age groups.

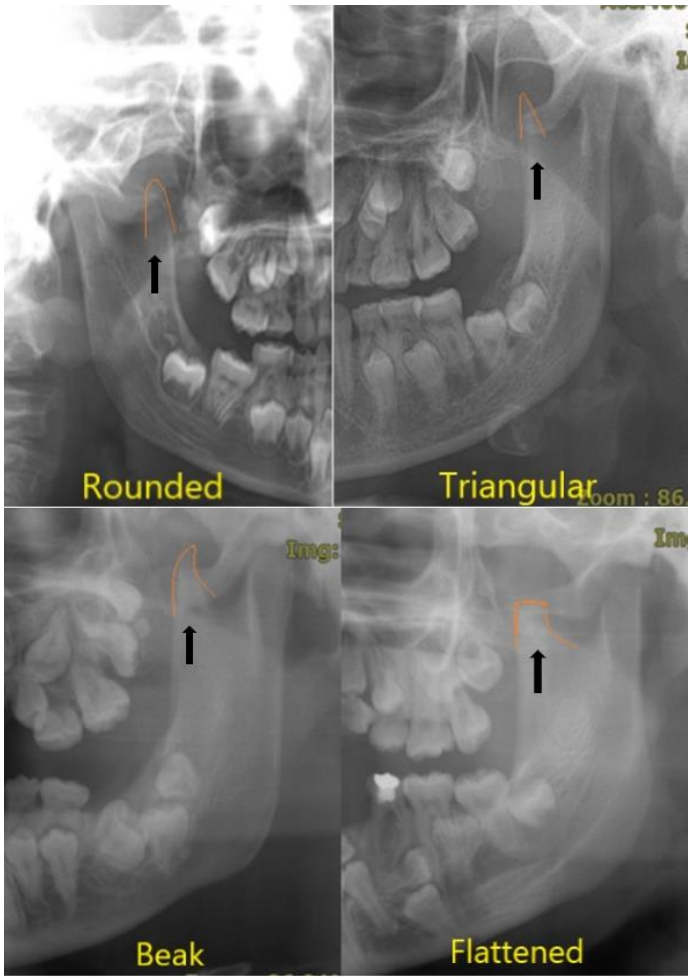

Figure 7. Classification of shape of the coronoid process.

9. Shape of sigmoid notch

The shape of sigmoid notch of each patient were classified into 3 type as round, sloping, and wide according to the Shakya et al.'s study (Figure 8) [16]. The shape of sigmoid notch was according to the sex and age groups.

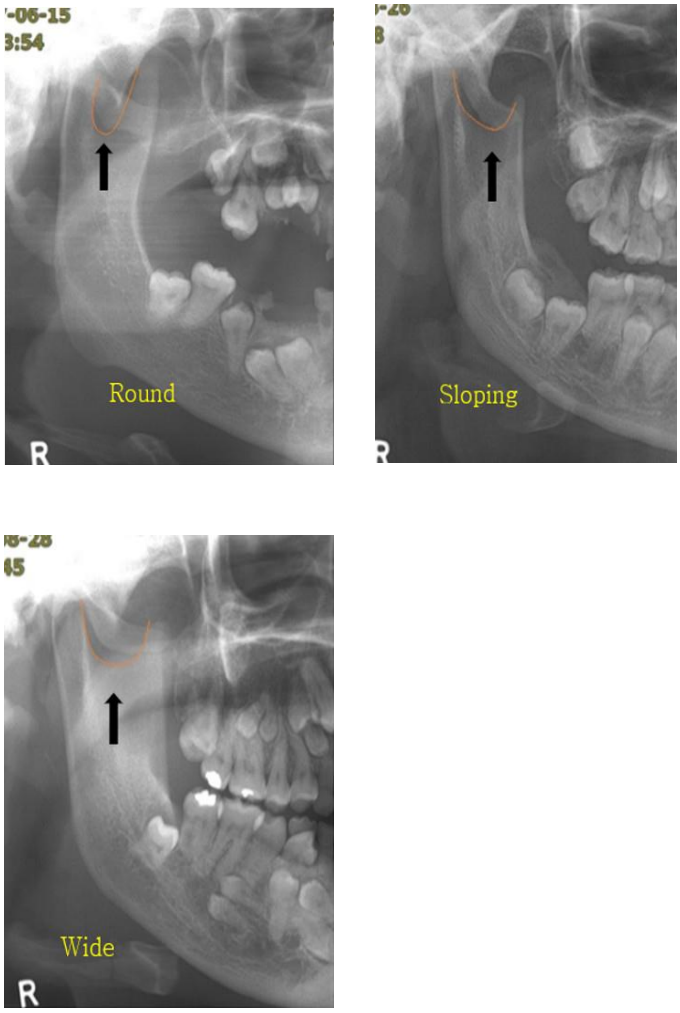

Figure 8. Classification of shape of sigmoid notch.

10. Shape of antegonial notch

The shape of antegonial notch mean point of deepest concavity between anterior convexity and inferior gonion. All of each patient is measured as the greatest point of convexity in the line connecting anterior convexity point (ACP) with gonion (Go) along the line perpendicular to the ACP-Go line according to Dutra et al.'s study [18]. Measurement the same way above, but this study divided different, as 3 type according the point of deepest antegonial notch showed according center line as posterior region are asymmetrical posterior, and anterior region are asymmetrical anterior. In case not showed the deepest or the deepest point showed in center are symmetrical notch (Figure 9). The analysis of shape of angtegonial notch was performed by 3 types according to the sex and age groups.

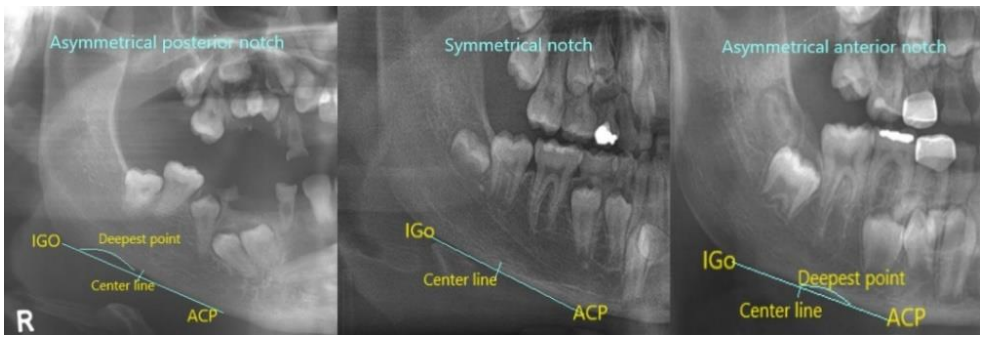

Figure 9. Classification of antegonial notch.

11. Shape of hard palate line

The shape of hard plate of each patient was classified into 7 types such as w shape, wide angle w shape, v shape, wide angle v shape, concave shape, convex shape and straight shape according to Damante et al.'s study (Figure 10) [19]. The analysis of shape of mandibular condyle was performed by an oral and maxillofacial radiologist according to the sex and age groups.

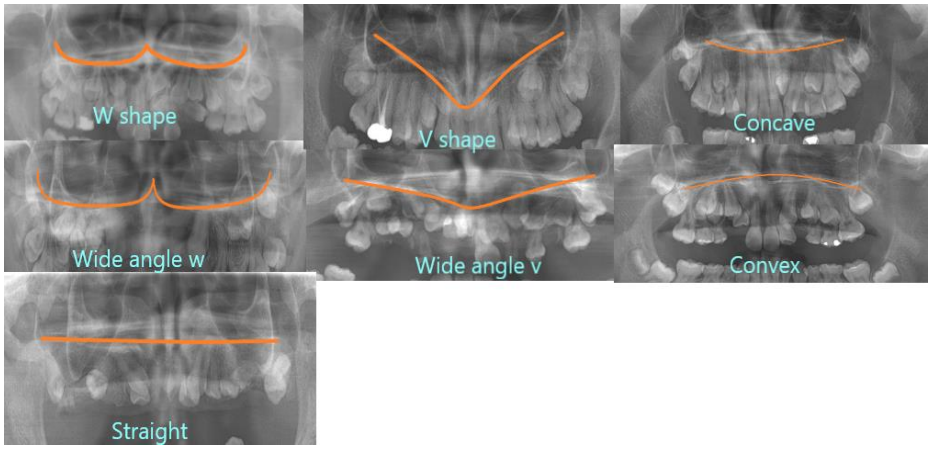

Figure 10. Classification of the shape of hard plate line.

12. Data analysis

Statistical analysis using the IBM SPSS ver. 25 (IBM Corp, Armonk, NY, USA). The data were checking the accuracy, completeness of each value and saved to coding and analysis first to produce descriptive statistics to describe the subjects with frequency of each variable, Then the data was examined analytically; was used to test for statistical differences between sex and age group and categorical variables.

RESULTS

Table 1 shows the distribution of patients with cleidocranial dysplasia by age group and sex in this study. Forty subjects were included in this study, and they were 8 (20.0%) in the 1-10 years age group, 13 (32.5%) in the 11-20 years age group, 13 (32.5%) in 21-30 years, 3 (7.5%) in 31-40 years, and 3 (7.5%) in over 40 years. Approximately, two-thirds of subjects were males (n=26) and one-third females (n=14). The patients' mean age was 21.3, and ranged from 5 to 59 (Table 1).

Table 1. Number of patients with cleidocranial dysplasia according to the sex and age group

Age group	Male	Female	Total
1 - 10 years	4 (10.0%)	4 (10.0%)	8 (20.0%)
11 - 20 years	8 (20.0%)	5 (12.5%)	13 (32.5%)
21 - 30 years	10 (25.0%)	3 (7.5%)	13 (32.5%)
31 - 40 years	2 (5.0%)	1 (2.5%)	3 (7.5%)
Over 40 years	2 (5.0%)	1 (2.5%)	3 (7.5%)
Total	26 (65.0%)	14 (35.0%)	40 (100.0%)

1. Number of supernumerary teeth

Table 2 shows the number of supernumerary teeth according to the age group and sex at each region. The mean numbers of supernumerary teeth per person were 6.4 in males, 5.5 in females, and 6.1 in total. Also, they were 4.4

in 1-10 years, 7.6 in 11-20 years, 4.8 in 21-30 years, 8.7 in 31-40, and 7.3 in over 40 years group, respectively.

Table 2. Number of supernumerary teeth according to the age group and sex at each region

		1-10		11-20		21-30		31-40		Over 40	
		M	F	M	F	M	F	M	F	M	F
Maxilla	Anterior	2	1	5	5	8	0	5	4	5	0
	Rt. premolar	3	2	12	4	7	2	0	2	1	0
	Rt. molar	0	0	3	1	3	1	0	1	0	0
	Lt. premolar	4	3	11	4	8	1	1	2	4	0
	Lt. molar	0	1	1	1	2	0	1	0	0	0
Mandible	Anterior	1	3	5	5	4	2	1	4	6	2
	Rt. premolar	5	1	13	6	10	2	0	2	2	0
	Rt. molar	0	1	3	1	3	0	0	0	0	0
	Lt. premolar	6	1	11	6	6	2	1	2	2	0
	Lt. molar	0	1	1	1	1	0	0	0	0	0
Total number		21	14	65	34	52	10	9	17	20	2
Mean number		5.3	3.5	8.1	6.8	5.2	3.3	4.5	17.0	10.0	2.0

M: male, F: female, Rt: right, Lt: left

Table 3 shows the number of patients according to the of supernumerary teeth according to the age group and sex. The greatest number of supernumerary teeth was 17 found in a patient, followed by 14, 11, and 10 found in 2 patients, 9 in 4 patients, 8 in 1 patient, 7 in 6 patients, 6 in 4 patients, 5 in a patient, 4 in 3 patients, 3 in 4 patients, 2 in 4 patients, and 1 in a patient. There were 5 patients who had not supernumerary teeth (1 males and 4 females).

Table 3. Number of patients according to the number of supernumerary teeth

Nsp.t	1-10		11-20		21-30		31-40		Over 40		Subtotal	
	M	F	M	F	M	F	M	F	M	F	M	F
0	0	1	0	1	1	2	0	0	0	0	1	4
1	0	1	0	0	0	0	0	0	0	0	0	1
2	1	0	0	0	2	0	0	0	0	1	3	1
3	1	0	1	1	1	0	0	0	0	0	3	1
4	0	0	1	0	1	0	1	0	0	0	3	0
5	0	0	0	0	0	0	1	0	0	0	1	0
6	1	0	0	0	2	0	0	0	1	0	4	0
7	0	2	2	1	1	0	0	0	0	0	3	3
8	0	0	0	1	0	0	0	0	0	0	0	1
9	1	0	1	0	2	0	0	0	0	0	4	0
10	0	0	1	0	0	1	0	0	0	0	1	1
11	0	0	1	1	0	0	0	0	0	0	1	1
12	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	1	0	0	0	0	0	1	0	2	0
15	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	1	0	0	0	1
Total	4	4	8	5	10	3	2	1	2	1	26	14

Nsp.t: number of supernumerary teeth, M: male, F: female

Table 4 shows the number of patients according to the number of supernumerary teeth at each region. According of number of supernumerary teeth the number of patients most found in premolar region on maxilla and mandible all of age group had with supernumerary teeth. The anterior region

on maxilla and mandible almost in age group in male found supernumerary teeth, except in the maxilla anterior region not found in female in age group 21-30, and age group over 40. The molar region in case of male age group 1-10, 31-40, and age group over 40 without of number supernumerary teeth, and in female age group 31-40 and over 40 (Table 3). The mean numbers of supernumerary teeth per person were 0.9 in the anterior, 0.8 in the right premolar, 0.9 in the left premolar, 0.2 in the right molar, and 0.2 in the left molar of maxilla, respectively. Also, they were 0.8 in the anterior, 1.0 in the right premolar, 0.9 in the left premolar, 0.2 in the right molar, and 0.1 in the left molar region on mandible, respectively.

Table 4. Number of patients according to the number of supernumerary teeth at each region

		Male						Female					
N supernumerary teeth		0	1	2	3	4	T	0	1	2	3	4	T
1-10 years													
Maxilla	Anterior	3	0	1	0	0	4	3	1	0	0	0	4
	Rt. premolar	1	3	0	0	0	4	2	2	0	0	0	4
	Rt. molar	4	0	0	0	0	4	4	0	0	0	0	4
	Lt. premolar	1	2	1	0	0	4	2	1	1	0	0	4
	Lt. molar	4	0	0	0	0	4	3	1	0	0	0	4
Mandible	Anterior	3	1	0	0	0	4	2	1	1	0	0	4
	Rt. premolar	1	1	2	0	0	4	3	1	0	0	0	4
	Rt. molar	4	0	0	0	0	4	3	1	0	0	0	4
	Lt. premolar	0	2	2	0	0	4	3	1	0	0	0	4
	Lt. molar	4	0	0	0	0	4	3	1	0	0	0	4
11-20													
Maxilla	Anterior	5	1	2	0	0	8	2	1	2	0	0	5
	Rt. premolar	1	2	5	0	0	8	2	2	1	0	0	5
	Rt molar	5	3	0	0	0	8	4	1	0	0	0	5
	Lt. premolar	2	1	5	0	0	8	2	2	1	0	0	5
	Lt. molar	7	1	0	0	0	8	4	1	0	0	0	5

Mandible	Anterior	4	3	1	0	0	8	3	1	0	0	1	5
	Rt. premolar	1	1	6	0	0	8	2	0	3	0	0	6
	Rt. molar	5	3	0	0	0	8	4	1	0	0	0	5
	Lt. premolar	1	3	4	0	0	8	2	0	3	0	0	5
	Lt. molar	7	1	0	0	0	8	4	1	0	0	0	5
21-30 years													
Maxilla	Anterior	4	4	2	0	0	10	3	0	0	0	0	3
	Rt. premolar	6	1	3	0	0	10	2	0	1	0	0	3
	Rt. molar	7	3	0	0	0	10	2	1	0	0	0	3
	Lt. premolar	5	2	3	0	0	10	2	1	0	0	0	3
	Lt. molar	8	2	0	0	0	10	3	0	0	0	0	3
Mandible	Anterior	6	4	0	0	0	10	2	0	1	0	0	3
	Rt. premolar	4	2	4	0	0	10	2	0	1	0	0	3
	Rt. molar	7	3	0	0	0	10	3	0	0	0	0	3
	Lt. premolar	6	2	2	0	0	10	2	0	1	0	0	3
	Lt. molar	9	1	0	0	0	10	3	0	0	0	0	3
31-40 years													
Maxilla	Anterior	0	0	1	1	0	2	0	0	0	0	1	1
	Rt. premolar	2	0	0	0	0	2	0	0	1	0	0	1
	Rt. molar	2	0	0	0	0	2	0	1	0	0	0	1
	Lt. premolar	1	1	0	0	0	2	0	0	1	0	0	1
	Lt. molar	1	1	0	0	0	2	1	0	0	0	0	1
Mandible	Anterior	1	1	0	0	0	2	0	0	0	0	1	1
	Rt. premolar	2	0	0	0	0	2	0	0	1	0	0	1
	Rt. molar	2	0	0	0	0	2	1	0	0	0	0	1
	Lt. premolar	1	1	0	0	0	2	0	0	1	0	0	1
	Lt. molar	2	0	0	0	0	2	1	0	0	0	0	1
Over 40 years													
Maxilla	Anterior	0	0	1	1	0	2	1	0	0	0	0	1
	Rt. premolar	1	1	0	0	0	2	1	0	0	0	0	1
	Rt. molar	2	0	0	0	0	2	1	0	0	0	0	1
	Lt. premolar	0	0	2	0	0	2	1	0	0	0	0	1
	Lt. molar	2	0	0	0	0	2	1	0	0	0	0	1
Mandible	Anterior	0	0	1	0	1	2	0	0	1	0	0	1
	Rt. premolar	1	0	1	0	0	2	1	0	0	0	0	1
	Rt. molar	2	0	0	0	0	2	1	0	0	0	0	1
	Lt. premolar	1	0	1	0	0	2	1	0	0	0	0	1
	Lt. molar	2	0	0	0	0	2	1	0	0	0	0	1

N: number, T: total, Rt: right, Lt: left

2. Number of impacted teeth

Table 5 shows the number of impacted teeth as well as erupted teeth of maxilla and mandible. Here, normal teeth included both of the primary and permanent teeth.

In the maxilla, the mean number of impacted teeth per patient was 8.3, ranging from 0 to 19. The number of impacted teeth on maxilla showed in the anterior region, followed by the premolar, and molar region. In the anterior, right premolar, right molar, and left molar regions, there were no statistical significances different between sexes and age group ($p>0.05$). There was statistical significance different between only sexes in the left premolar region ($p<0.05$).

In the mandible, the greatest number of impacted teeth showed in anterior region, followed by premolar region, and molar region. The anterior, left premolar, right molar, and left molar regions showed no statistical significance different between sexes and age group ($p>0.05$). There was a statistical significance difference between the age group only in the right premolar region ($p<0.05$).

Table 5. Number of normal erupted and impacted teeth according to the region, sex, and age group

		Right molar		Right premolar		Anterior		Left premolar		Left molar	
		Erupted	Impacted	Erupted	Impacted	Erupted	Impacted	Erupted	Impacted	Erupted	Impacted
Maxilla											
Male	1-10 (N=4)	3	0	7	0	9	5	7	0	4	0
	11-20 (N=8)	10	1	12	13	24	31	14	12	9	1
	21-30 (N=10)	16	1	17	8	40	21	16	7	15	1
	31-40 (N=2)	4	0	4	0	11	5	4	2	3	1
	Over 40 (N=2)	0	0	2	3	0	5	2	4	0	0
	Total	33	2	42	35	84	67	43	25	31	3
Female	1-10 (N=4)	1	0	8	0	24	0	8	0	1	0
	11-20 (N=5)	5	0	10	4	18	15	10	3	3	0
	21-30 (N=3)	5	0	4	2	13	7	5	2	5	0
	31-40 (N=1)	2	0	2	0	6	2	2	0	2	0
	Over 40 (N=1)	0	0	0	0	2	0	0	0	0	0
	Total	13	0	24	6	63	24	25	5	11	0
Mandible											
Male	1-10 (N=4)	3	0	8	0	20	0	8	0	3	0
	11-20 (N=8)	8	4	12	14	43	10	12	13	9	5
	21-30 (N=10)	12	7	14	14	47	14	13	12	15	5

	31-40 (N=2)	3	1	4	1	12	3	4	1	4	1
	Over 40 (N=2)	1	1	2	2	1	6	1	2	0	1
	Total	27	13	40	31	123	33	38	28	31	12
Female	1-10 (N=4)	2	0	8	0	21	0	8	0	3	0
	11-20 (N=5)	6	1	10	5	24	6	8	6	7	1
	21-30 (N=3)	3	2	6	2	18	8	6	4	5	1
	31-40 (N=1)	2	0	2	2	5	2	2	2	2	0
	Over 40 (N=1)	0	0	0	1	1	3	2	0	0	0
	Total	13	3	26	10	69	19	26	12	17	2

N: number

3. Shape of the ascending ramus

Table 6 shows the shape of ascending ramus include parallelism and normal shape according to the sex and age group. When the near parallel or parallel side border was found, it was regarded as “parallelism”, and “normal” when not found. In case of male, there were 20 (76.9%) patients with parallelism, and 6 (23.1%) patients with normal ascending ramus. In case of female, there were 12 (85.7%) patients with parallelism and 2 (14.2%) with normal ascending ramus. In total, 32 (80.0%) patients showed parallel ascending ramus. That shape of ascending ramus was related with patient with cleidocranial dysplasia in this study. However, there was no statistically significant difference between the sexes and between the age groups ($p>0.05$).

Table 6. Number of patients according to the shape of ascending ramus according to the sex and age group

Sex	Age group	Number	Parallelism	Normal
Male	1-10	4	3 (75.0%)	1 (25.0%)
	11-20	8	6 (75.0%)	2 (25.0%)
	21-30	10	7 (70.0%)	3 (30.0%)
	31-40	2	2 (100.0%)	0 (0.0%)
	Over 40	2	2 (100.0%)	0 (0.0%)
	Subtotal	26	20 (76.9%)	6 (23.1%)
Female	1-10	4	4 (50.0%)	0 (50.0%)
	11-20	5	5 (60.0%)	0 (40.0%)
	21-30	3	1 (66.7%)	2 (33.3%)
	31-40	1	1 (100.0%)	0 (0.0%)
	Over 40	1	1 (100.0%)	0 (0.0%)
	Subtotal	14	12 (85.7%)	2 (14.2%)
Total		40	32 (80.0%)	8 (20.0%)

4. Size of maxillary sinus

Table 7 shows the number of patients according to the size of maxillary sinus. Small sized maxillary sinus was revealed in 18 (69.2%) in male patients and 11 patients (78.6%) in female patients. The small sized maxillary sinus was related with the patients of cleidocranial dysplasia in this study. However, there were no statistical significance according to the sexes and age groups (p>0.05). There was no patient who had different size between the right and left maxillary sinus.

Table 7. Number of patients according to the size of maxillary sinus, sex, and age group

Sex	Age group	N	Small size		Normal size	
			Right	Left	Right	Left
Male	1-10	4	4 (100%)	4 (100%)	0 (0.0%)	0 (0.0%)
	11-20	8	7 (87.5%)	7 (87.5%)	1 (12.5%)	1 (12.5%)
	21-30	10	5 (50.0%)	5 (50.0%)	5 (50.0%)	5 (50.0%)
	31-40	2	2 (100%)	2 (100%)	0 (0.0%)	0 (0.0%)
	Over 40	2	0 (0.0%)	0 (0.0%)	2 (100%)	2 (100%)
	Total	26	18 (69.2%)	18 (69.2%)	8 (30.8%)	8 (30.8%)
Female	1-10	4	4 (100%)	4 (100%)	0 (0.0%)	0 (0.0%)
	11-20	5	3 (60.0%)	3 (60.0%)	2 (40.0%)	2 (40.0%)
	21-30	3	2 (66.7%)	2 (66.7%)	1 (33.3%)	1 (33.3%)
	31-40	1	1 (100%)	1 (100%)	0 (0.0%)	0 (0.0%)
	Over 40	1	1 (100%)	1 (100%)	0 (0.0%)	0 (0.0%)
	Total	14	11 (78.6%)	11 (78.6%)	3 (21.4%)	3 (21.4%)

N: number

5. Presence or absence of mandibular midline

Table 8 shows of the number of patients who had mandibular midline suture according sex and age group. When the mandibular suture was found, it was regarded as “presence” of mandibular midline suture, and “absence” when not found. The mandibular midline suture was found only 5 patients in the total, and they were 1 male and 2 females in 1-10 years, 1 female in 11-20 years, and 1 female in 31-40 years, respectively. Therefore, mandibular midline suture was not related with the patients of cleidocranial dysplasia.

Table 8. Number of patents with mandibular midline suture according to the sex and age group

Sex	Age group	Number	Presence	Absence
Male	1-10	4	1 (25.0%)	3 (75.0%)
	11-20	8	0 (0.0%)	8 (100%)
	21-30	10	0 (0.0%)	10 (100%)
	31-40	2	0 (0.0%)	2 (100%)
	Over 40	2	0 (0.0%)	2 (100%)
	Total	26	1 (3.8%)	25 (96.2%)
Female	1-10	4	2 (50.0%)	2 (50.0%)
	11-20	5	1 (20.0%)	4 (80.0%)
	21-30	3	0 (0.0%)	3 (100%)
	31-40	1	1 (100%)	0 (0.0%)
	Over 40	1	0 (0.0%)	1 (100%)
	Total	14	4 (28.6%)	10 (71.4%)

6. Mandibular angle

Table 9 shows the number of patients according to the mandibular angle, sex, and age group. In case of male, the most patients showed the angle as 110.00˚-120.00˚, followed by 120.01˚-130.00˚, 130.01˚-140.00˚ and last one over 140˚. In case of female, the number of patients were same (N=4) in 3 groups of mandibular angle, 110.00˚-120.00˚, 120.01˚-130.00˚, and 130.01˚-140.00˚, and there were 2 patients in the group of over 140˚ mandibular angle. There was no statistical significance between the sexes and between the right and left side. Also, there was no statistical significance between the age groups, too (Table 9).

Table 9. Number of patients according to the mandibular angle, sex, and age group

Sex	Age group	N	110.00˚-120.00˚		120.01˚-130.00˚		130.01˚-140.00˚		Over 140.00˚	
			Right	Left	Right	Left	Right	Left	Right	Left
M	1-10	4	1 (25.0%)	1 (25.0%)	3 (75.0%)	3 (75.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
	11-20	8	5 (62.5%)	4 (50.0%)	2 (25.0%)	3 (37.5%)	1 (12.5%)	1 (12.5%)	0 (0.0%)	0 (0.0%)
	21-30	10	4 (40.0%)	4 (40.0%)	3 (30.0%)	3 (30.0%)	2 (20.0%)	2 (20.0%)	1 (10.0%)	1 (10.0%)
	31-40	2	1 (50.0%)	1 (50.0%)	1 (50.0%)	1 (50.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
	Over 40	2	1 (50.0%)	1 (50.0%)	1 (50.0%)	1 (50.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
	Total	26	12 (46.1%)	11 (42.3%)	10 (38.4%)	11 (42.3%)	3 (11.5%)	3 (11.5%)	1 (3.8%)	1 (3.8%)
F	1-10	4	0 (0.0%)	0 (0.0%)	3 (75.0%)	3 (75.0%)	1 (25.0%)	1 (25.0%)	0 (0.0%)	0 (0.0%)
	11-20	5	2 (40.0%)	2 (40.0%)	1 (20.0%)	1 (20.0%)	1 (20.0%)	2 (40.0%)	1 (20.0%)	0 (0.0%)
	21-30	3	1 (33.3%)	1 (33.3%)	0 (0.0%)	0 (0.0%)	1 (33.3%)	1 (33.3%)	1 (33.3%)	1 (33.3%)
	31-40	1	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (100%)	0 (0.0%)	0 (0.0%)	1 (100%)
	Over 40	1	1 (100%)	1 (100%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
	Total	14	4 (28.6%)	4 (28.6%)	4 (28.6%)	4 (28.6%)	4 (28.6%)	4 (28.6%)	2 (14.3%)	2 (14.3%)

N: number, M: male, F: female

7. Shapes of mandibular condyle

Table 10 shows of the number of patients according to the shape of mandibular condyle for each sexes and age group. In male patients, the greatest number of mandibular condyles showed rounded shape (18, 69.2%) on the right and 14, 53.8%) on the left), followed by convex shape (6, 23.1% on the right and 9, 34.6% on the left), flattened shape (1, 3.8%) on the right, and 2, 7.7%) on the left), angle shape (1, 3.8% on the right and 1, 3.8% on the left side). In female patients, the greatest number of mandibular condyles showed rounded shape (9, 64.2%) on the right and 8, 57.1% on the left), followed by convex shape (2, 12.2% on the right and 5, 35.7%) on the left), angle shape (3, 21.4%) on the right and 1, 7.1% on the left side), and there was no patient who had flattened shape of mandibular condyle.

Table 10. Number of patients according to the shape of mandibular condyle, sex, and age group

Sex	Age group	N	Rounded shape		Angle shape		Convex shape		Flattened shape	
			Right	Left	Right	Left	Right	Left	Right	Left
Male	1-10	4	2 (50.0%)	2 (50.0%)	0 (0.0%)	0 (0.0%)	2 (50.0%)	2 (50.0%)	0 (0.0%)	0 (0.0%)
	11-20	8	6 (75.0%)	6 (75.0%)	0 (0.0%)	0 (0.0%)	2 (25.0%)	2 (25.0%)	0 (0.0%)	0 (0.0%)
	21-30	10	8 (80.0%)	4 (40.0%)	0 (0.0%)	1 (10.0%)	1 (10.0%)	3 (30.0%)	1 (10.0%)	2 (20.0%)
	31-40	2	1 (50.0%)	2 (100.0%)	1 (50.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
	Over 40	2	1 (50.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (50.0%)	2 (100%)	0 (0.0%)	0 (0,0%)
	Total	26	18 (69.2%)	14 (53.8%)	1 (3.8%)	1 (3.8%)	6 (23.1%)	9 (34.6%)	1 (3.8%)	2 (7.7%)
Female	1-10	4	4 (100%)	4 (100%)	0(0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
	11-20	5	2 (40.0%)	1 (20.0%)	2 (40.0%)	1 (20.0%)	1 (20.0%)	3 (60.0%)	0 (0.0%)	0 (0.0%)
	21-30	3	2 (66.7%)	2 (66.7%)	1 (33.3%)	0 (0.0%)	0 (0.0%)	1 (33.3%)	0 (0.0%)	0 (0.0%)
	31-40	1	1 (100%)	1 (100%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
	Over 40	1	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (100%)	1 (100%)	0 (0.0%)	0 (0.0%)
	Total	14	9 (64.2%)	8 (57.1%)	3 (21.4%)	1 (7.1%)	2 (14.2%)	5 (35.7%)	0 (0.0%)	0 (0.0%)

N: number

8. Shapes of coronoid process

Table 11 shows the number of patients according to the shapes of coronoid process of each sexes and age group. In case of male, the most patients showed triangular shape followed by rounded, beak, and flattened shape. In case of female, however, the most patients showed rounded shape, followed by triangular, and flattened shape. There was no beak shape of coronoid process in female patients (Table 11).

Table 11. Number of patients according to the shape of coronoid process, sex, and age group

Sex	Age group	N	Triangular		Rounded		Beak		Flattened	
			Right	Left	Right	Left	Right	Left	Right	Left
Male	1-10	4	1 (25.0%)	1 (25.0%)	2 (50.0%)	2 (50.0%)	0 (0.0%)	0 (0.0%)	1 (25.0%)	1 (25.0%)
	11-20	8	3 (37.5%)	3 (37.5%)	3 (37.5%)	3 (37.5%)	2 (25.0%)	2 (25.0%)	0 (0.0%)	0 (0.0%)
	21-30	10	8 (80.0%)	8 (80.0%)	0 (0.0%)	1 (10.0%)	1 (10.0%)	1 (10.0%)	1 (10.0%)	0 (0.0%)
	31-40	2	0 (0.0%)	0 (0.0%)	1 (50.0%)	1 (50.0%)	1 (50.0%)	1 (50.0%)	0 (0.0%)	0 (0.0%)
	Over 40	2	0 (0.0%)	0 (0.0%)	1 (50.0%)	1 (50.0%)	1 (50.0%)	0 (0.0%)	0 (0.0%)	1 (50.0%)
	Total	26	12 (46,1%)	12 (46.1%)	7 (26.9%)	8 (30.7%)	5 (19.2%)	4 (15.3%)	2 (7.6%)	2 (7.6%)
Femal e	1-10	4	0 (0.0%)	0 (0.0%)	4 (100%)	4 (100%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
	11-20	5	2 (40,0%)	2 (40.0%)	3 (60.0%)	3 (60.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
	21-30	3	2 (66.7%)	3 (100%)	1 (33.3%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
	31-40	1	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (100%)	1 (100%)
	Over 40	1	1 (100%)	1 (100%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
	Total	14	5 (35.8%)	6 (42.8%)	8 (57.1%)	7 (50.0%)	0 (0.0%)	0 (0.0%)	1 (7.1%)	1 (7.1%)

M: male, F: female

9. Shapes of sigmoid notch

Table 12 shows of the number of patients according to the shape of sigmoid notch of each sex and age group. In both sexes, the most patients showed rounded shape, followed by wide, and sloping shape. There were no statistical significance different side with both sexes and age group ($p>0.05$).

Table 12. Number of patients according to the shape of sigmoid notch, sex, and age group

Sex	Age group	N	Rounded		Wide		Sloping	
			Right	Left	Right	Left	Right	Left
Male	1-10	4	3 (75.0%)	3 (75.0%)	0 (0.0%)	0 (0.0%)	1 (25.0%)	1 (25.0%)
	11-20	8	3 (37.5%)	3 (37.5%)	5 (62.5%)	5 (62.5%)	0 (0.0%)	0 (0.0%)
	21-30	10	4 (40.0%)	8 (80.0%)	5 (50,0%)	1 (10.0%)	1 (10.0%)	1 (10.0%)
	31-40	2	0 (0.0%)	1 (50.0%)	2 (100%)	1 (50.0%)	0 (0.0%)	0 (0.0%)
	Over 40	2	1 (50.0%)	1 (50.0%)	0 (0.0%)	1 (50.0%)	1 (50.0%)	0 (0.0%)
	Total	26	11 (42.3%)	16 (61.5%)	12 (46.1%)	8 (30.7%)	3 (11.5%)	2 (7.7%)
Female	1-10	4	3 (75.0%)	3 (75.0%)	1 (25.0%)	1 (25.0%)	0 (0.0%)	0 (0.0%)
	11-20	5	2 (40.0%)	2 (40.0%)	2 (40.0%)	2 (40.0%)	1 (20.0%)	1 (20.0%)
	21-30	3	1 (33.3%)	1 (33.3%)	1 (33.3%)	1 (33.3%)	1 (33.3%)	1 (33.3%)
	31-40	1	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (100%)	1 (100%)
	Over 40	1	0 (0.0%)	0 (0.0%)	1 (100%)	1 (100%)	0 (0.0%)	0 (0.0%)
	Total	14	6 (7.5%)	6 (7.5%)	5 (6.2%)	5 (6.2%)	3 (3.7%)	3 (3.7%)

N: number

10. Shape of antegonial notch

Table 13 shows of the number of patients according of shapes antegonial notch. In male patients, the most number showed asymmetrical posterior notch, followed by asymmetrical anterior notch, and symmetrical notch. In case of female, the most number showed asymmetrical posterior notch, followed by symmetrical notch, and asymmetrical anterior notch. There was no statistical significance between the sexes and between the right and left side. Also, there was no statistical significance between the age groups, too ($p>0.05$).

Table 13. Number of patients according to the shape of antegonial notch, sex, and age group

Sex	Age group	N	Asymmetrical post notch		Symmetrical notch		Asymmetrical ant notch	
			Right	Left	Right	Left	Right	Left
Male	1-10	4	2 (50.0%)	2 (50.0%)	0 (0.0%)	0 (0.0%)	2 (50.0%)	2 (50.0%)
	11-20	8	4 (50.0%)	4 (50.0%)	1 (12.5%)	2 (25.0%)	3 (37.5%)	2 (25.0%)
	21-30	10	6 (60.0%)	6 (60.0%)	2 (20.0%)	2 (20.0%)	2 (20.0%)	2 (20.0%)
	31-40	2	1 (50.0%)	1 (50.0%)	1 (50.0%)	1 (50.0%)	0 (0.0%)	0 (0.0%)
	Over 40	2	0 (0.0%)	0 (0.0%)	1 (50.0%)	1 (50.0%)	1 (50.0%)	1 (50.0%)
	Total	26	13 (50.0%)	13 (50.0%)	5 (19.2%)	6 (23.1%)	8 (30.8%)	7 (26.9%)
Female	1-10	4	2 (50.0%)	3 (75.0%)	2 (50.0%)	1 (25.0%)	0 (0.0%)	0 (0.0%)
	11-20	5	2 (40.0%)	3 (60.0%)	2 (40.0%)	1 (20.0%)	1 (20.0%)	1 (20.0%)
	21-30	3	1 (33.3%)	1 (33.3%)	0 (0.0%)	0 (0.0%)	2 (66.7%)	2 (66.7%)
	31-40	1	0 (0.0%)	1 (100%)	1 (100%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
	Over 40	1	0 (0.0%)	0 (0.0%)	1 (100%)	1 (100%)	0 (0.0%)	0 (0.0%)
	Total	14	5 (35.7%)	8 (57.1%)	6 (42.9%)	3 (21.4%)	3 (214%)	3 (21.4%)

N: number

11. Shapes of hard palate

Table 14 shows number of patients according to the shapes of hard palate. In case of male, the most number showed wide angle w shape, followed by w shape, straight, v shape, convex, wide angle v, and concave shape. In case of female, the most number showed w shape, followed by wide w, wide v, convex, straight, v shape. There was no concave shape of hard palate in female patients.

Table 14. Number of patients according to the shape of hard palate, sex, and age group

Sex	Age group	N	W	Wide angle w	V	Wide angle v	Concave	Convex	Straight
Male	1-10	4	1 (25.0%)	0 (0.0%)	1 (25.0%)	1 (25.0%)	0 (0.0%)	1 (25.0%)	0 (0.0%)
	11-20	8	3 (37.5%)	2 (25.0%)	1 (12.5%)	0 (0.0%)	0 (0.0%)	1 (12.5%)	1 (125%)
	21-30	10	0 (0.0%)	5 (50.0%)	1 (10.0%)	1 (10.0%)	0 (0.0%)	1 (10.0%)	2 (20.0%)
	31-40	2	2 (100%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
	Over 40	2	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (50.0%)	0 (0.0%)	1 (50.0%)
	Total	26	6 (23.1%)	7 (26.9%)	3 (11.5%)	2 (7.7%)	1 (3.8%)	3 (11.5%)	4 (15.4%)
Female	1-10	4	2 (50.0%)	0 (0.0%)	1 (25.0%)	0 (0.0%)	0 (0.0%)	1 (25.0%)	0 (0.0%)
	11-20	5	1 (20.0%)	0 (0.0%)	0 (0.0%)	2 (40.0%)	0 (0.0%)	0 (0.0%)	2 (40.0%)
	21-30	3	1 (33.3%)	2 (66.7%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
	31-40	1	1 (100%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
	Over 40	1	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (100%)	0 (0.0%)
	Total	14	5 (35.7%)	2 (14.2%)	1 (7.1%)	2 (14.2%)	0 (0.0%)	2 (14.2%)	2 (14.2%)

N: number

DISCUSSION

This study was performed to investigate the features of dental and maxillofacial radiographs in patients with cleidocranial dysplasia in Seoul National University Dental Hospital between January 2004 to December 2018. There were 26 males and 14 females, mean of aged 21.32, range of aged from 5 to 59.

Richardson et al. [1] reported that there were 63 supernumerary teeth in total in the 13 subjects, mostly occurred in the mandibular premolar and maxillary incisor region, two patients had no supernumerary teeth in the patients of cleidocranial dysplasia. In 1999, McNamara et al. [7] reported 9 cases of Caucasian males with cleidocranial dysplasia. They found 6 supernumeraries in the maxillary incisor region, and 5 in the maxilla and mandible premolar region. The shape of ascending ramus of all patients showed parallel-side. There were 2 patients who showed mandibular midline suture and 4 patients with small maxillary sinus. Bufalino et al.'s study [25] showed 20 supernumerary teeth in an 18-years-old girl, and the supernumerary teeth were mostly located in the premolar region of maxilla and mandible. In 2017, Farrow et al. [2] reviewed the 8 patients with cleidocranial dysplasia based on 4 males and 4 females. In their report, there were only 1 case with no supernumerary teeth.

In this study, regarding the number of supernumerary teeth according

to the age group and sex at each region, the mean number of supernumerary teeth per person were 6.4 in males, 5.5 in females, and 6.1 in total. Also, they were 4.4 in 1-10 years, 7.6 in 11-20 years, 4.8 in 21-30 years, 8.7 in 31-40, and 7.3 in over 40 years group, respectively. The greatest number of supernumerary teeth was 17 found in a patient, followed by 14, 11, and 10 found in 2 patients, 9 in 4 patients, 8 in 1 patient, 7 in 6 patients, 6 in 4 patients, 5 in a patient, 4 in 3 patients, 3 in 4 patients, 2 in 4 patients, and 1 in a patient. There were 5 patients who had not supernumerary teeth, one male and four females. But more than 1 supernumerary tooth per normal tooth was never observed. The mean numbers of supernumerary teeth per person were 0.9 in the anterior, 0.8 in the right premolar, 0.9 in the left premolar, 0.2 in the right molar, and 0.2 in the left molar of maxilla, respectively. Also, they were 0.8 in the anterior, 1.0 in the right premolar, 0.9 in the left premolar, 0.2 in the right molar, and 0.1 in the left molar region on mandible, respectively.

Regarding the number of impacted teeth, normal teeth included both of the primary and permanent teeth in this study. In maxilla, the mean number of impacted teeth per patient was 8.3, ranging from 0 to 19. The number of impacted teeth of maxilla showed in the anterior region, followed by the premolar, and molar region. The anterior, right premolar, right molar, and left molar regions showed no statistically significant difference between the sexes and age groups ($p>0.05$). The left premolar region Only showed statistically significant difference between the sexes ($p<0.05$). In mandible, the greatest number of impacted teeth showed in the anterior region, followed by the

premolar region, and molar region. The anterior, left premolar, right molar, and left molar regions showed no statistically significant difference between the sexes and age group ($p>0.05$). The right premolar region only showed statistically significant difference between the age groups ($p<0.05$).

According to this study, the mandibular midline suture might not be related with cleidocranial dysplasia. However, in the McNamara et al.'s study [7], there were 2 cases of mandibular midline suture in 9 patients; therefore, more study would be required to investigate their relationship in the future.

The small size of maxillary sinus was strongly related with cleidocranial dysplasia patient according to this study. This result accorded with the McNamara et al.'s study [7] which reported small size of maxillary sinus in 4 cases of 9 patients. However, there was no statistically significant difference between of the both side, sexes, and age groups ($p>0.05$).

Regarding the shape of coronoid process, the most commonly observed coronoid process was triangular shape, followed by rounded, beak and flattened shape in males, and the most commonly observed was rounded, followed by triangular, flattened not founded beak shape in females. These results pertained with the Sahithi et al.' study [17] among 200 panoramic images, that is most common observed was triangular shape, followed by round, beak, and flattened shape. Shakya et al. [16], Sudha et al. [21], and Pradhan et al. [22] had also reported the triangular shape to be common, followed by rounded, beak, and flat shape were rare, which were performed on the normal population in the Indian populations. These observations were in contradictory

to the studies by Kahlon and Agnihotri [26] study (2020) with 500 adults human mandible, that they reported the round shape to be common, followed by triangular, and hook shape.

Regarding the shape of sigmoid notch in this study, the most commonly observed sigmoid notch was rounded shape, followed by wide, and sloping shape which were not in accordance with the study by Shakya et al. [16], and Nagaraj et al. [15]. Also, it was different from the Sahithi et al.'s study [17], that the most commonly observed was the wide shape, followed by round, and sloping shape.

The shape of mandibular condyle was frequently observed in the rounded shape, followed by convex, angle and flattened shape. Sahithi et al. [17] frequently observed was round, followed by angled, convex, and flattened shape, which was pertaining to Nagaraj et al. [15] and Choudhary et al. [23] in normal adult population.

Regarding the shapes of hard palate, the most commonly observed shape was the wide angle w shape, followed by w shape, straight, v shape, convex, wide angle v, and concave shape in males. Also, the greatest number of patients showed w shape, followed by wide w, wide v, convex, straight, and v shape, and there was no concave shape of hard palate in females. These results accorded with the Dumante et al's study [19]; therefore, the shape of hard palate was not related with the cleidocranial dysplasia. However, the quality of panoramic radiographs should be considered for this study since the shape of hard palate can be affected by the patient's positioning while taking the

panoramic radiograph. Although panoramic radiographs of low quality were excluded in this study, the results might be affected by the image quality in this study.

CONCLUSION

Panoramic radiographs were valuable to identified more feature and confirming the diagnosis of cleidocranial dysplasia. According to the results of this study, the number of supernumerary and impacted teeth, size of maxillary sinus, shape of ascending ramus and sigmoid notch were related with cleidocranial dysplasia. Therefore, these features can be considered in the diagnosis of cleidocranial dysplasia. In future research, more of case and feature on panoramic radiographs need to be gathered to improve the performances of the method.

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국문 초록

쇄골두개형성이상 환자의 파노라마방사선영상에서 관찰되는 치아 및 악골의 방사선학적 특성

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1. 목적

본 연구는 쇄골두개형성이상 환자의 파노라마방사선영상에서 관찰되는 특징을 확인하고자 시행되었다.

2. 재료 및 방법

서울대학교치과병원에서 쇄골두개형성이상으로 진단된 40명의 환자로부터 획득한 40매의 파노라마방사선영상을 이용하여 단면 연구로 시행되었다. 2004년부터 2018년까지 쇄골두개형성이상으로 진단된 환자의 임상 및 방사선 기록을 전자치과기록 및 PACS를 이용하여 평가하였다. 2회 이상 파노라마방사선영상을 획득한 환자의 경우에는 최초에 촬영한 파노라마방사선영상을 선택하였다. 각

영상에서 다음의 특징을 평가하였다. 1) 과잉치의 수, 2) 매복치의 수, 3) 하악지의 형태, 4) 상악동의 크기, 5) 하악골 정중봉합, 6) 하악각의 형태, 7) 하악과두의 형태, 8) 관상돌기의 형태, 9) S 자절흔의 형태, 10) 전악각의 형태, 11) 경구개의 형태. 본 연구에서 제 3 대구치는 치아 수를 평가할 때 제외하였다.

3. 결과

각 부위의 연령대 및 성별에 따른 과잉 치아의 수 평가 시, 1 인당 평균 과잉치의 수는 남자 6.4 개, 여자 5.5 개로 총 6.1 개였다. 또한 연령별로는 1 ~ 10 세에서 4.4, 11 ~ 20 세에서 7.6, 21 ~ 30 세에서 4.8, 31 ~ 40 세에서 8.7, 40 세 이상에서 7.3 개였다. 환자 당 과잉치가 1 환자에서 17 개가 가장 많았고, 그 다음으로는 2 환자에서 14, 11, 10 개였으며, 4 환자에서 9 개, 1 환자에서 8 개, 6 환자에서 7 개, 4 환자에서 6 개, 1 환자에서 5 개, 3 환자에서 4 개, 4 환자에서 3 개, 4 환자에서 2 개, 1 환자에서 1 개, 5 환자에서는 과잉치가 관찰되지 않았다. 1 인당 평균 과잉치 수는 상악의 경우 전치에서 0.9, 우측 소구치 0.8, 좌측 소구치 0.9, 우측 대구치 0.2,

좌측 대구치 0.2 개였고 하악의 경우에는 전치부 0.8, 우측 소구치 1.0, 좌측 소구치 0.9, 우측 대구치 0.2, 좌측 대구치 0.1 개였다.

매복치의 수를 평가했을 때, 상악의 경우에는, 환자 1 인당 평균 매복치 수는 8.3 개였고 환자에 따라 0 개에서 19 개의 매복치가 관찰되었다. 상악 매복치의 수는 전치부에서 가장 많았고 그 다음으로 소구치, 대구치 부위 순이었다. 전치부, 우측 소구치, 우측 대구치, 좌측 대구치에서는 성별과 연령대에 따른 통계적 유의성이 없었고 좌측 소구치 부위에서 성별에 따른 통계적으로 유의한 차이가 나타났다($p<0.05$). 하악의 경우에는, 전치부에서 매복치의 수가 가장 많았고 그 다음으로 소구치, 대구치 부위 순이었다. 전치부, 좌측 소구치, 우측 대구치, 좌측 대구치 부위는 성별과 연령대에 따른 통계적으로 유의한 차이가 나타나지 않았다($p> 0.05$). 우측 소구치 부위에서만 연령대에 따라 통계적으로 유의한 차이가 있었다 ($p<0.05$).

하악지의 형태는 전체적으로 32 명의 환자에서 하악지 전연과 후연이 평행한 형태를 보였으나 성별과 좌우의 차이는 통계적으로 유의하지 않았고 연령대 간의 연관성도 통계적으로 유의하지 않았다($p>0.05$).

쇄골두개형성이상 환자의 상악동 크기는 정상인에 비하여 작은 것으로 나타났으나 성별과 연령대 간에 통계적 유의성은 없었다($p>0.05$). 하악골 정중봉합은 5명의 환자에서 관찰되었다. 하악각은 110.00°-120.00°인 환자가 가장 많았고 그 다음으로 120.01°-130.00°, 130.01°-140.00°, 140° 이상의 순서로 나타났으며 성별과 연령대 간에 유의한 차이는 나타나지 않았다($p>0.05$).

하악과두의 형태는, 남성의 경우 둥근 형태가 가장 많았고그 다음으로 볼록, 납작, 각진 형태의 순이었으며 여성의 경우에는 둥근 형태가 가장 많았고 그 다음으로 볼록, 각진 형태의 순이었다. 관상돌기는 남성의 경우 삼각 형태가 가장 많았고 그 다음으로 둥글고 부리와 납작한 모양이었으며, 여성의 경우에는 둥근 형태가 가장 많았고, 삼각형, 납작한 형태의 순이었으며 부리 형태는 발견되지 않았다.

S자형 절흔은 남성과 여성 모두에서 둥근 형태가 가장 많았고 그 다음으로 넓은 형태, 경사진 형태의 순이었다.

전악각은 남성의 경우에 비대칭 후방절흔이 가장 많았고, 비대칭 전방절흔과 대칭절흔의 순으로 나타났으며, 여성의 경우에는 비

대칭 후방절흔, 대칭절흔, 비대칭 전방절흔의 순으로 나타났다. 성별 및 연령에 따른 유의성은 나타나지 않았다($p>0.05$).

경구개의 형태는, 남성의 경우 넓은 w 자형, w, 직선형, 볼록형, v 자형 및 넓은 v 자형, 오목형의 순으로 나타났고, 여성의 경우에는 w 자형, 넓은 w 자형, 넓은 v 자형, 볼록, 직선 및 v 자형의 순이었으며 오목형의 경구개는 관찰되지 않았다.

4. 결론

파노라마방사선영상은 쇄골두개형성이상의 특징을 이해하고 이를 진단하는데 유용한 영상이다. 이 연구의 결과에 따르면 과잉치와 매복치의 수, 상악동의 크기, 하악지 형태, S자형 절흔의 형태 이상이 쇄골두개형성이상과 관련이 있었다. 따라서 이러한 특징은 쇄골두개형성이상 진단에서 고려될 수 있다. 향후 연구에서 콘빔CT 등과 같은 특수영상을 이용하면 쇄골두개형성이상 환자의 치아와 악골에서 나타나는 더 많은 특징과 정보를 얻을 수 있을 것이다.

주요어: 쇄골두개형성이상; 파노라마방사선영상; 치아; 상악골; 하악골; 경구개

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