Three-dimensional computed tomography analysis of mandibular morphology in patients with facial asymmetry and mandibular retrognathism

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Three-dimensional computed tomography analysis of mandibular morphology in patients with facial asymmetry and mandibular retrognathism

A Dissertation
Submitted to the Department of Dentistry
and the Graduate School of Yonsei University
in partial fulfillment of the
requirements for the degree of
Doctor of Philosophy of Dental Science

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December 2016

This certifies that the dissertation

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December 2016

감사의 글

교정학에 입문할 수 있는 기회를 주시고, 부족한 제가 본 논문을 완성할 수 있도록 아낌없이 배려해 주시고, 많은 지도를 해주신 백형선 교수님께 진심으로 감사 드립니다. 또한, 본 논문이 완성될 때까지, 지속적으로 여러 관심과 도움을 주셨던 김경호 교수님, 이기준 교수님, 김기덕 교수님, 정영수 교수님께도 깊은 감사의 말씀을 전합니다.

특히, 이번에는 진료와 논문을 병행하느냐고 많은 어려움들이 있었는데, 이러한 어려움들을 극복하고 본 논문이 완성되도록 주위에서 많은 도움을 주었던 가족 및 모든 분들에게 이 자리를 빌어 깊은 감사의 마음을 보냅니다.

2016년 12월

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ABSTRACT

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Department of Dentistry

(Directed by Prof. Hyoung Seon Baik, D.D.S., M.S.D., Ph.D.)

The assessment of mandibular asymmetry is needed for understanding the characteristics of facial asymmetry. However, a review of the literature revealed no studies that evaluated mandibular asymmetry by skeletal units in the retrusive mandible. Therefore, the purpose of this study was to analyze the morphologic features of skeletal units in the mandibles of patients with facial asymmetry and mandibular retrognathism using CBCT.

The subjects consisted of 50 adults with facial asymmetry and mandibular retrognathism, divided into the symmetry group (n = 25) and the asymmetry group (n = 25) according to the degree of menton deviation (MD). Three-dimensional computed tomography scans were obtained with cone beam computed tomography. Landmarks were designated on the reconstructed 3D images. Linear and volumetric measurements were done on the mandibles.

1. In the asymmetry group, the lengths of condylar, body and coronoid units were shorter, condylar width was narrower, and ramal height and body length were shorter on the deviated side than on the non-deviated side ($P < 0.01$).
2. In the asymmetry group, the lengths of angular and chin units were not significantly different between the deviated and non-deviated sides ($P > 0.05$).
3. In the asymmetry group, hemi-mandibular, ramal, and body volumes were lesser on the deviated side than on the non-deviated side ($P < 0.01$).
4. In the asymmetry group, menton deviation was significantly correlated with the differences in condylar unit length ($P < 0.01$), ramal height ($P < 0.01$), and ramal volume ($P < 0.05$) between the non-deviated and deviated sides.

Therefore, it is necessary to carefully evaluate the characteristics of condylar, body and coronoid units in the treatment of the asymmetric mandible in patients with retrusive mandible.

Key words: facial asymmetry, mandibular retrognathism, 3-dimension, CBCT, skeletal unit

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I. INTRODUCTION

Facial asymmetry is defined as the inconsistency in size, shape and arrangement of one side of the face from the opposite side when viewed in relation to the medial sagittal plane. Facial asymmetry is important in esthetic evaluation of the craniofacial region. Facial asymmetry within limit is recognized as normal, but, severe asymmetry of the facial features is not acceptable.[1] Facial asymmetry is a common finding. It was reported that 34% of patients who visited the University of North Carolina for orthodontic evaluation had facial asymmetry, and 75% of those had deviation of chin.[2]

Two-dimensional (2D) x-ray films such as posteroanterior cephalogram, submento-vertex view, and panoramic view have been used as diagnostic methods of facial asymmetry. However, the reliability of these 2D X-ray films is limited in the diagnosis of facial asymmetry.[3] Using three-dimensional computed tomography (3D CT) imagings, clinicians can observe the outer and inner structures of an object precisely. Also, it enables volumetric measurement of the craniofacial structures. In dentistry, cone beam CT (CBCT) is used widely because of less radiation dose and low cost. Also, because CBCT ensure high-dimensional accuracy in measurement of the facial structures,[4] CBCT is an excellent method for evaluation of facial asymmetry.

Previous 2D studies reported that facial asymmetry is more prominent in the lower part of the face.[5,6] Likewise, previous 3D studies in patients with madibular prognathism paid attention to the morphology of the mandible such as ramal height, body length and ramal inclination, and showed a result that mandible is a dominant factor in facial asymmetry.[7,8] Therefore, the assessment of mandibular asymmetry is needed for understanding the characteristics of facial asymmetry.

Because the mandible might be a composite of relatively independent skeletal units including condylar process, coronoid process, angular process, alveolar process, body and chin,[9] the analysis of the mandible by skeletal units might help to understand the etiology of mandibular asymmetry. You et al. examined the mandibles of patients with facial asymmetry and mandibular prognathism, and concluded that both condylar and body units contribute to mandibular asymmetry, with a more central role of condylar unit.[10]

However, a review of the literature revealed no studies that evaluated mandibular asymmetry by skeletal units in the retrusive mandible. Therefore, the purpose of this study was to analyze the morphologic features of skeletal units in the mandibles of patients with facial asymmetry and mandibular retrognathism using CBCT.

II. MATERIAL AND METHOD

This retrospective study conformed to the tenets of the Declaration of Helsinki on medical protocols and ethnics, and was approved by the institutional review board at Yonsei Dental Hospital, Seoul, Korea (IRB number 2-2016-0029).

1. Subjects

50 adults were selected from the patients who visited the Yonsei University Dental Hospital, Seoul, KOREA for the orthodontic and orthognathic treatments from 2011 through 2016. The inclusion criteria were as followings; (1) age older than 19 years; (2) ANB > 4.0°; (3) Pog to N perpendicular < -6.0 mm; (4) 32.0° < SN-GoMe < 40.0°; (5) no presence of systemic disease; (6) no osteoarthritis in the temporomandibular joint; (7) no history of trauma in the craniofacial region.

The subjects were divided into 2 groups according to the degree of menton deviation (MD) from the midsagittal reference plane.[11] The symmetry group consisted of 25 adults (13 men, 12 women), whose MDs were less than 2 mm from the midsagittal reference plane. The asymmetry group consisted of 25 adults (11 men, 14 women), whose MDs were more than 4 mm from the midsagittal reference plane. The characteristics of subjects in both groups are shown in Table 1.

2. CBCT scanning and 3D images

All subjects underwent CBCT examinations (Alphard3030, Asahi Roentgen Inc., Kyoto, Japan) as part of diagnostic record gathering. CBCT scanning of the maxillofacial regions was performed for 17 s, with a field of view of 20 × 17.9 cm, 80 kVp, and 5 mA. The subjects were positioned to be seated in an upright position. The CBCT scan data were converted into digital imaging and communication in medicine (DICOM) format in 0.390-mm slice thicknesses. Craniofacial 3D images were reconstructed from the DICOM data using the InVivo dental software program (version 5.1, Anatomage, San Jose, CA). In volume render, the mandibles were separated from the reconstructed 3D images, and the teeth above the alveolar bone in the mandibles were removed.

Table 1. The characteristics of subjects in the symmetry and asymmetry groups

Variable	*Mean*	*SD*	*Minimum*	*Maximum*
Symmetry group (n = 25)				
Age (y)	22.8	4.2	19.0	35.0
ANB (˚)	7.7	2.4	5.3	13.5
Pog to N perpendicular (mm)	-7.9	3.3	-15.0	-6.1
MD (mm)	1.2	0.5	0.4	2.0
SN-GoMe (˚)	37.0	3.3	32.0	39.8
Asymmetry group (n = 25)				
Age (y)	22.7	6.3	19.0	38.0
ANB (˚)	7.2	1.9	5.1	10.3
Pog to N perpendicular (mm)	-8.0	3.2	-14.0	-6.0
MD (mm)	6.9	2.9	4.0	11.3
SN-GoMe (˚)	36.2	3.4	32.5	39.9

3. Landmarks and measurements

Landmarks and measurements were selected according to the study of You et al.[9]. Landmarks were designated on the surface of reconstructed 3D images, and were verified on the axial, coronal, and sagittal views. All landmarks are shown in Figure 1 and Table 2. Linear and volumetric measurements are shown in Figure 1. The mandibular volume was divided into two hemi-mandibular volumes by the plane connecting Menton, B, and G. Hemi-mandibular volume was divided into ramal and body volumes by the plane connecting Go_{mid}, J_{lat}, and J_{med}. The data were measured in increments of 0.01 mm for linear measurements, and 0.01 x 10^3 mm^3 for volumetric measurements.

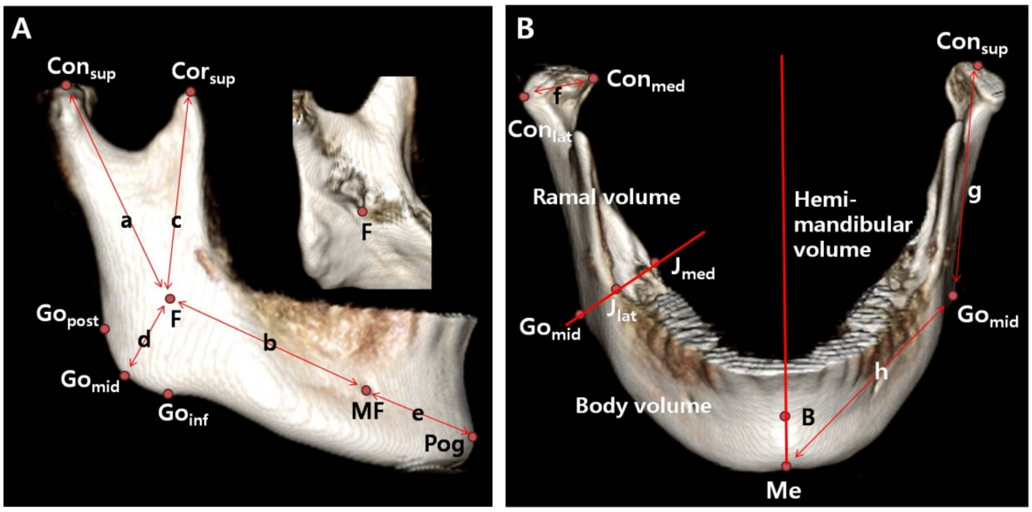

Figure 1. Landmarks and measurements used in this study: A, a, condylar unit length; b, body unit length; c, coronoid unit length; d, angular unit length; e, chin unit length. B, f, condylar width; g, ramal height; h, body length.

Table 2. Description of mandibular landmarks

Landmark	*Definition*
Con_{sup} (condylion superius)	The most superior point of the condylar head
Con_{med} (condylion medialis)	The most medial point of the condylar head
Con_{lat} (condylion lateralis)	The most lateral point of the condylar head
Cor_{sup} (coronoid superius)	The most superior point of the coronoid process
F (fossa of mandibular foramen)	The most inferior point on the fossa of the mandibuar foramen
J_{lat}	The most lateral and deepest point of the curvature formed at the junction of the mandibular ramus and body
J_{med}	The most medial and deepest point of the curvature formed at the junction of the mandibular ramus and body
Go_{post} (gonion posterius)	The most posterior point on the mandibular angle
Go_{mid} (gonion midpoint)	The midpoint between Go_{post} and Go_{inf} on the mandibular angle
Go_{inf} (gonion inferius)	The most inferior point on the mandibular angle
MF (mental foramen)	The entrance of the mental foramen
Me (menton)	The most inferior midpoint on the symphysis
Pog (pogonion)	The most anterior midpoint on the symphysis
B (supramentale)	The midpoint of the greatest concavity on the anterior border of the symphysis
G (genial tubercle)	The midpoint on genial tubercle

4. Statistical analysis

Two weeks after the first measurements, all measurements were performed in randomly selected 30 subjects to examine intraobserver and interobserver errors by 3 observers. The two assessments by each observer were analyzed with the intraclass correlation for intraobserver reliability. The first and second assessments of the 3 observers were compared for interobserver reliability respectively. The method errors were calculated with the Dahlberg formula.[12] The Shapiro-Wilk test showed that all measurements were normally distributed. The two sample t-test was used to determine the possible statistically significant differences between the male and female groups, and between the symmetry and asymmetry groups. 1-way analysis of variance (ANOVA) and the Tukey test were used to compare the measurements between the sides in the symmetry group, and the deviated and non-deviated sides in the asymmetry groups. The paired t-test was performed to compare the measurements between the non-deviated and deviated sides in the asymmetry group. The Pearson correlation analysis was used to determine correlations between MD and measurements. All statistical analyses were performed using the SPSS (Statistical Package for Social Science for Windows, version 24, IBM) at the 5% level of significance.

Ⅲ. RESULTS

1. Intraobserver and interobserver errors

Intraclass correlation coefficients were from 0.909 to 0.967 for intraobserver reliability, and from 0.906 to 0.945 for interobserver reliability. The method errors ranged from 0.02 mm to 0.49mm for linear measurements, and from 0.03×10^3 mm^3 to 0.09×10^3 mm^3 for volumetric measurements.

2. Comparison of measurements between the male and female groups

No differences were found for all measurements between both groups ($P > 0.05$). Therefore, no differentiation was made for sex in this study.

3. Measurements in the symmetry and asymmetry groups

There were no significant differences in all characteristics of subjects except MD between the symmetry and asymmetry groups. In the symmetry group, there were no significant differences in all measurements between the non-deviated and deviated sides ($P > 0.05$). Therefore, the mean values of the both sides were used in the symmetry group.

On the deviated side in the asymmetry group, the lengths of condylar, body and coronoid units were significantly shorter, condylar width was significantly narrower, and ramal height and body length were significantly shorter than on the sides in the symmetry group and the non-deviated side in the asymmetry group (Table 3). The lengths of angular and chin units were not significantly different ($P > 0.05$; Table 3).

In the asymmetry group, hemi-mandibular, ramal, and body volumes were significantly lesser on the deviated side than on the non-deviated side ($P < 0.05$; Table 3).

4. Linear measurements in the asymmetry group

The lengths of condylar, body and coronoid units were significantly shorter on the deviated side than on the non-deviated side ($P < 0.01$; Table 4). All 25 subjects showed that condylar unit lengths were shorter on the deviated side than on the non-deviated side, but 4 subjects showed that body unit lengths were longer on the deviated side than on the non-deviated side. The difference in condylar unit length was significantly greater than the difference in body unit length ($P < 0.01$; Table 4). Only 1 subjects showed that the difference in body unit length were greater than the difference in condylar unit length.

Condylar width was significantly narrower, and ramal height and body length were significantly shorter on the deviated side than on the non-deviated side ($P < 0.01$; Table 4). The lengths of angular and chin units were not significantly different between the 2 sides ($P > 0.05$; Table 4).

MD was significantly correlated with the differences in condylar unit length and ramal height ($P < 0.01$; Table 4). No significant correlation was found between the differences in the lengths of skeletal units ($P > 0.05$; Table 5).

Table 3. Data on measurements in the symmetry and asymmetry groups, and comparison between the symmetry and asymmetry groups (1 way ANOVA with Tukey post-hoc test)

Measurement	*Symmetry group (1)*	*Asymmetry group*		*Comparison*			*P Value*
		Non-deviated side (2)	*Deviated side (3)*	*1-2*	*1-3*	*2-3*	
Condylar unit length (mm)	47.45 ± 5.46	48.65 ± 5.91	41.06 ± 6.04	-1.20	6.39**	7.59**	<0.001**
Body unit length (mm)	50.68 ± 3.97	51.00 ± 3.80	49.06 ± 4.00	-0.32	1.62*	1.94*	0.012*
Coronoid unit length (mm)	42.10 ± 2.19	41.76 ± 2.04	40.46 ± 2.18	0.34	1.64*	1.30*	0.014*
Angular unit length (mm)	20.13 ± 1.99	20.46 ± 1.47	21.01 ± 2.28	-0.33	-0.88	-0.55	0.693
Chin unit length (mm)	29.45 ± 1.93	30.74 ± 1.92	30.29 ± 1.95	-1.29	-0.84	0.45	0.726
Condylar width (mm)	17.08 ± 2.33	17.60 ± 2.48	15.17 ± 2.50	-0.52	1.91*	2.43**	<0.001**
Ramal height (mm)	56.22 ± 6.00	58.48 ± 4.48	51.72 ± 5.34	-2.26	4.50*	6.76**	<0.001**
Body length (mm)	82.85 ± 5.12	84.02 ± 4.13	80.97 ± 4.61	-1.17	1.88*	3.05*	0.011*
Hemi-mandibular volume (10^3 mm^3)	18.87 ± 2.85	19.23 ± 2.98	17.90 ± 2.76	-0.36	0.97	1.33*	0.013*
Ramal volume (10^3 mm^3)	4.99 ± 0.85	5.13 ± 0.93	4.53 ± 0.84	-0.14	0.46	0.60*	0.011*
Body volume (10^3 mm^3)	13.88 ± 2.32	14.10 ± 2.14	13.37 ± 1.99	-0.22	0.51	0.73*	0.018*

$^{*}P < 0.05$, $^{**}P < 0.01$

Table 4. The differences in the linear measurements between the non-deviated and deviated sides (paired t-test), and correlation with MD (Pearson correlation analysis) in the asymmetry group

Measurement (mm)	*Mean*	*SD*	*Minimum*	*Maximum*	*P value*	*Correlation with MD (P value)*
Condylar unit length diff.	7.59	5.02	1.80	18.55	<0.001**	0.912 (<0.001**)
Body unit length diff.	1.94	2.06	-2.11	4.88	0.003**	0.494 (0.085)
Coronoid unit length diff.	1.30	2.02	-2.27	5.34	0.002**	0.403 (0.165)
Angular unit length diff.	-0.55	1.81	-2.45	3.45	0.583	0.234 (0.793)
Chin unit length diff.	0.45	1.94	-2.89	3.81	0.826	0.321 (0.648)
Condylar width diff.	2.43	1.83	-0.50	6.12	<0.001**	0.371 (0.225)
Ramal height diff.	6.76	5.02	-0.90	18.31	<0.001**	0.814 (0.001**)
Body length diff.	3.05	2.64	-1.33	7.43	<0.001**	0.612 (0.054)

***P* < 0.01; diff., non-deviated side minus deviated side

Table 5. Correlation between the differences in the lengths of skeletal units in the asymmetry group (Pearson correlation analysis)

Correlation coefficient (P value)	*Body unit length diff.*	*Coronoid unit length diff.*	*Angular unit length diff.*	*Chin unit length diff.*
Condylar unit length diff.	0.212(0.503)	0.574 (0.083)	0.019 (0.944)	0.291 (0.338)
Body unit length diff.		-0.432 (0.121)	-0.372 (0.219)	0.285 (0.347)
Coronoid unit length diff.			0.097 (0.766)	-0.079 (0.793)
Angular unit length diff.				-0.119 (0.671)

Diff., non-deviated side minus deviated side

5. Volumetric measurements in the asymmetry group

Hemi-mandibular, ramal, and body volumes were significantly lesser on the deviated side than on the non-deviated side ($P < 0.01$; Table 6). MD was significantly correlated with the difference in ramal volume ($P < 0.05$; Table 6). The difference in ramal volume was significantly correlated with the differences in condylar unit length and ramal height ($P < 0.01$; Table 7), but the difference in body volume was not significantly correlated with the difference in body length ($P > 0.05$; Table 7).

Table 6. The differences in the volumetric measurements between the non-deviated and deviated sides (paired t-test), and correlation with MD (Pearson correlation analysis) in the asymmetry group

Measurement (10^3 mm^3)	*Mean*	*SD*	*Minimum*	*Maximum*	*P value*	*Correlation with MD (P value)*
Hemi-mandibular volume diff.	1.33	0.84	0.04	2.54	<0.001**	0.459 (0.117)
Ramal volume diff.	0.60	0.45	0.06	1.10	<0.001**	0.612 (0.028*)
Body volume diff.	0.73	0.55	-0.16	1.50	0.001**	0.241 (0.451)

*$P < 0.05$, **$P < 0.01$; diff., non-deviated side minus deviated side

Table 7. Correlation between the differences in linear and volumetric measurements in the asymmetry group (Pearson correlation analysis)

Correlation coefficient (P value)	*condylar unit length diff.*	*coronoid unit length diff.*	*Ramal height diff.*	*Body length diff.*
Ramal volume diff.	0.540(0.004**)	0.145(0.481)	0.529(0.009**)	
Body volume diff.				-0.255(0.208)

***P* < 0.01; diff., non-deviated side minus deviated side

6. Schematic diagram

Combining all the results, a schematic diagram of the asymmetric mandible is shown in Figure 2.

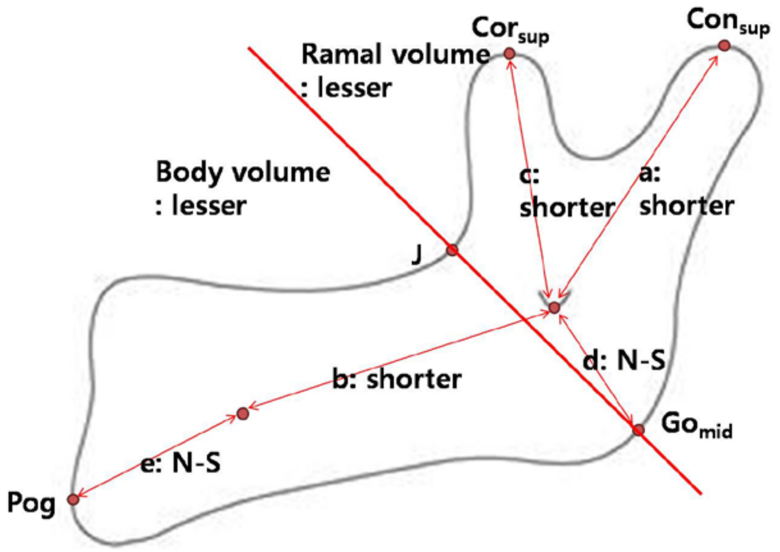

Figure 2. Schematic diagram of morphologic changes on the deviated side compared with the non-deviated side in the mandibles of patients with facial asymmetry and mandibular retrognathism: a, condylar unit length; b, body unit length; c, coronoid unit length; d, angular unit length; e, chin unit length; N-S, not significant.

IV. DISCUSSION

Two-dimensional (2D) cephalometric analysis has been useful for evaluating facial asymmetry. However, the measurements based on 2D x-ray films have several limitations such as overlap of adjacent structures as well as magnification and projection errors. Recently, three-dimensional (3D) imaging has been used for the assessment of the craniofacial structures because of high-dimensional accuracy. In particular, 3D analysis is essential for evaluation of facial asymmetry. Spiral CT offer more improved contrast and resolution, and more accuracy in the linear and volumetric measurements of craniofacial imaging compared with CBCT.[13] However, the intra- and interobserver reliabilities of three-dimensional cepahlometric landmark identification were excellent for CBCT.[14] Also, it was reported that there was no significant difference in measuring length and volume using CBCT compared with spiral CT, and CBCT ensures high accuracy in the measurements of the mandibular structures.[15] Similarly, in evaluating the reproducibility of linear and volumetric measurements, our results showed that correlation coefficients were higher than 0.9, which showed that the linear and volumetric measurements in the mandible from CBCT are reproducible. Besides, because the experience of the operator has a positive effect on the accuracy and reproducibility of measurements,[15] landmark identification and measurements were carried out by an experienced examiner in this study.

Analyzing the mandible by skeletal units is useful for understanding the etiology and characteristics of the asymmetric mandible. In this study, the mandible was divided into condlylar, body, coronoid, angular, and chin units on the basis of the mandibular and mental foramens as proposed by You et al.[10]. In evaluation of the lengths of skeletal units in the asymmetry group, the lengths of condylar and body units were significantly shorter on the deviated side than on the non-deviated side. Unlike condylar and body units, the differences in the lengths of angular and chin units were not significantly different between 2 sides. These results were in concordance with the results obtained in the research in the asymmetric mandibles of patients with facial asymmetry and mandibular prognathism,[10] and indicated that the asymmetric mandible is correlated with condylar and body units, whereas that are not correlated with angular and chin units. Also, our results showed that no significant correlation was found between the differences in the lengths of skeletal units. Therefore, the independent shortening of condylar and body units might be caused by or lead to asymmetry of the retrusive mandible.

The degree of menton deviation (MD) from the midsagittal reference plane is used as an evaluation standard for the diagnosis of mandibular asymmetry. The correlations between menton deviation and skeletal units are helpful to understanding the characteristics of mandibular asymmetry. In this study, MD was correlated with the difference in condylar unit length, and was not correlated with the difference in body unit length. Also, the difference in condylar unit length was significantly greater than the difference in body unit length, and 24 of 25 subjects showed that the differences in condylar unit length were greater than the differences in body unit length. When these results were combined, condylar unit appears to play a more dominant role in asymmetry of the retrusive mandible than body unit.

In patients with facial asymmetry and mandibular prognathism, MD was correlated with the difference in the lengths of condylar and body units. However, in this study, MD was correlated with the difference in condylar unit length, but it was not correlated with the difference in body unit length. Also, previous study reported that only ramus length presented a statistically significant right-left difference between mandibular retrusion and prognathism.[16] These findings suggest that condylar unit is more correlated with MD in the retrusive mandible than in the protrusive mandible.

The condylar cartilage might be an important growth site in the mandible.[17] However, its exact role in the development of the mandible is not known. Some investigators reported that the internal derangement of temporomandibular joint is associated with mandibular asymmetry.[18,19] The present study showed that condylar width was significantly narrower on the deviated side than on the non-deviated side. Therefore, the low growth or degeneration of the condylar head appears to be caused by or lead to asymmetry of the retrusive mandible.

In this study, coronoid unit length was significantly shorter on the deviated side than on the non-deviated side. Contrary to this finding, coronoid unit length was significantly longer on the deviated side than on the non-deviated side in patients with facial asymmetry and mandibular prognathism.[10] The coronoid process might be affected by the temporalis muscle.[20] However, the volume of the temporalis muscle was not significantly different between the non-deviated and deviated sides in patients with unilateral hemifacial microsomia,[21] and with facial asymmetry and protrusive mandible.[7] Combining these results, it can be inferred that coronoid unit is not correlated with the volume of the temporalis muscle. Further studies regarding the relationship between coronoid unit and activity of the temporal muscle are needed.

In this study, body unit length was shorter, and body volume was lesser on the deviated side than on the non-deviated side, but the difference in body volume was not significantly correlated with the difference in body length. Also, in patients with facial asymmetry and mandibular prognathism, body unit length was longer on the non-deviated side than on the deviated side, but body volume was not significantly different between the deviated and non-deviated sides.[10] When taken together, it can be inferred that compensatory bone resorption and/or apposition are occurred in the body of the asymmetric mandible. It is in concordance with the results that excessive inferiorly directed bone growth was occurred along the lower border of the mandibular body on the side with disk displacement in growing rabbits.[22]

It is difficult to understand the precise pathogenesis of the asymmetric mandible based on our results. Longitudinally, the research into morphologic changes at skeletal units might be helpful for understanding the etiology of mandibular asymmetry in patients with facial asymmetry.

V. Conclusion

This study evaluated the morphologic features of skeletal units in the mandibles of patients with facial asymmetry and mandibular retrognathism using CBCT. The subjects consisted of 50 adults with facial asymmetry and mandibular retrognathism, divided into the symmetry group (n = 25) and the asymmetry group (n = 25) according to the degree of menton deviation (MD). Linear and volumetric measurements were done on the mandibles. The results were as followings.

1. In the asymmetry group, the lengths of condylar, body and coronoid units were shorter, condylar width was narrower, and ramal height and body length were shorter on the deviated side than on the non-deviated side ($P < 0.01$).
2. In the asymmetry group, the lengths of angular and chin units were not significantly different between the deviated and non-deviated sides ($P > 0.05$).
3. In the asymmetry group, hemi-mandibular, ramal, and body volumes were lesser on the deviated side than on the non-deviated side ($P < 0.01$).
4. In the asymmetry group, menton deviation was significantly correlated with the differences in condylar unit length ($P < 0.01$), ramal height ($P < 0.01$), and ramal volume ($P < 0.05$) between the non-deviated and deviated sides.

Therefore, it is necessary to carefully evaluate the characteristics of condylar, body and coronoid units in the treatment of the asymmetric mandible in patients with retrusive mandible.

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국문요약

3차원 단층 촬영을 이용한 하악골 후퇴증을 동반한 안면비대칭자의 하악골 형태 분석

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유 국 호

안면비대칭의 특징들을 이해하는데 있어 하악골의 비대칭을 평가하는 것은 중요하다. 그러나, 후퇴된 하악골을 골격 부위들로 나누어 하악골의 비대칭을 연구한 논문은 없다. 이 연구의 목적은 콘빔 단층 촬영장치 (CBCT)를 이용하여 하악골 후퇴증을 동반한 안면비대칭자의 하악골에서 골격 부위들의 형태학적 특징들을 분석하는 것이다.

안면 비대칭과 하악골 후퇴증이 있는 성인 50명을 대상으로, 턱끝점의 편위 정도에 따라 대칭 군 (25명)과 비대칭 군(25명)으로 나누었다. 콘빔 단층

촬영장치를 이용하여 3차원 단층 촬영 자료들을 얻은 뒤, 하악골 영상에서 길이와 부피 항목들을 계측하였다.

1. 비대칭 군에서, 비편위측에 비하여 편위측에서 하악과두, 하악체, 오훼돌기 부위 길이들이 짧았고, 하악과두 폭이 좁았으며, 하악지 길이와 하악체 길이도 짧았다 ($P < 0.01$).
2. 비대칭 군에서, 하악각 및 턱끝 부위 길이들은 비편위측과 편위측이 차이가 없었다 ($P > 0.05$).
3. 비대칭 군에서, 비편위측에 비하여 편위측에서 하악골, 하악지 및 하악체 부피들이 적었다 ($P < 0.01$).
4. 비대칭 군에서, 턱끝점의 편위 정도는 하악과두 부위 길이 ($P < 0.01$), 하악지 길이 ($P < 0.01$) 및 하악지 부피 ($P < 0.01$)의 비편위측과 편위측 차이들과 연관성이 있었다.

그러므로, 하악골 후퇴증을 동반한 안면비대칭자의 비대칭 하악골의 치료에 있어서는, 하악과두, 하악체, 오훼돌기 부위의 특징들을 잘 평가하는 것이 중요하다.

핵심되는 말 : 안면비대칭, 하악 후퇴증, 3차원, CBCT, 골격 부위