Original Article

Comparison of condylar size among different anteroposterior and vertical skeletal patterns using cone-beam computed tomography

Atsushi Hasebe[a]; Tetsutaro Yamaguchi[b]; Takatoshi Nakawaki[c]; Yu Hikita[a]; Koushu Katayama[a]; Koutaro Maki[d]

ABSTRACT

Objectives: To compare condylar size among different anteroposterior and vertical skeletal patterns using cone-beam computed tomography (CBCT).

Materials and Methods: The study included 166 subjects (61 men, mean age: 27.2 ± 7.6 years; 105 women, mean age: 27.4 ± 9.2 years). The anteroposterior skeletal patterns of the subjects were classified into Classes I ($-1° \leq$ A point–nasion–B point angle [ANB] $< 4°$), II (ANB $\geq 4°$), and III (ANB $< -1°$). The vertical skeletal patterns were classified into hypodivergent (mandibular plane [MP] $\leq 23°$), normodivergent ($23° <$ MP $< 30°$), and hyperdivergent (MP $\geq 30°$) groups. The condylar length, height, and width were examined using CBCT images. Analysis of covariance was used to compare three condylar size measurements among the three anteroposterior groups and the three vertical groups using sex as a covariate. Both left and right sides were examined. Nine groups were further divided according to the anteroposterior and vertical groups, and two-way analysis of covariance (ANCOVA) was applied to estimate the composite effect of skeletal patterns in both directions.

Results: Sex as a covariate showed statistical significance in most examinations. The condylar height on both sides had statistically different anteroposterior skeletal patterns ($P < .001$). The condylar width on both sides also had statistically different vertical skeletal patterns ($P < .001$). After adjusting for sex, the condylar height and width on both sides increased from Class II, Class I, and Class III. The condylar width on both sides increased from the hypodivergent group, the normodivergent group, and the hyperdivergent group. No composite effect of skeletal patterns in both directions was observed.

Conclusions: Condylar height and width considerably differed among subjects with different anteroposterior or vertical skeletal patterns. The anteroposterior or vertical skeletal patterns independently affected the condylar size. (*Angle Orthod.* 2019;89:306–311.)

KEY WORDS: Condylar size; Cone-beam computed tomography; Skeletal pattern; Vertical; Anteroposterior; Malocclusion

INTRODUCTION

A complicated combination of skeletal and denture component incongruities in the craniomaxillofacial region contributes to malocclusion.[1] Condylar morphology plays an important role in orthodontic treatment planning.[2] Moreover, skeletal pattern is involved in orthodontic diagnosis, treatment, or therapeutic response;[2] for example, control of the vertical dimension during orthodontic treatment is of major importance in subjects with hyperdivergence.[3]

Conventional radiographic images used in orthodontic treatment (cephalometric and panoramic radiographs) do not provide clear or multidirectional views of the temporomandibular joints (TMJ).[4] Cone-beam computed tomography (CBCT) is beneficial for dental

[a] Research Fellow, Department of Orthodontics, School of Dentistry, Showa University, Tokyo, Japan.
[b] Associate Professor, Department of Orthodontics, School of Dentistry, Showa University, Tokyo, Japan.
[c] Assistant Professor, Department of Orthodontics, School of Dentistry, Showa University, Tokyo, Japan.
[d] Professor, Department of Orthodontics, School of Dentistry, Showa University, Tokyo, Japan.
Corresponding author: Dr Tetsutaro Yamaguchi, Department of Orthodontics, School of Dentistry, Showa University, 2-1-1 Kitasenzoku, Ohta-ku, Tokyo 145-8515, Japan
(e-mail: tyamaguchi@dent.showa-u.ac.jp)

Accepted: September 2018. Submitted: March 2018.
Published Online: November 26, 2018

and maxillofacial use because of its shortened scan time and high-resolution images. CBCT is used in various fields, including for the diagnosis of TMJ disorders and orthodontics.[5–7] Saccucci et al.[8] attempted to determine the condylar volume in subjects with different anteroposterior and vertical skeletal patterns and found that greater condylar volume was a common characteristic of subjects with hypodivergence compared with the subjects with normodivergence and hyperdivergence. They also reported that skeletal class was associated with the condylar volume and surface. However, the morphological features that can cause differences in the condylar volume have not been clarified. Park et al.[2] compared condylar morphology among different vertical skeletal patterns and found that the hypodivergent and hyperdivergent groups showed significant differences in several condylar linear measurements. The subjects of their study included those with flattened condyles or osteophytes. The study examined 20 subjects in each group, with a combination of men and women in each group. The condylar morphology in subjects with temporomandibular disorder (TMD)[9,10] and in subjects with facial or mandibular asymmetry[11–13] has also been observed. However, it is surprising that little is known about the condylar morphology in subjects with different anteroposterior and vertical skeletal patterns.

The purpose of this study was to compare condylar size among adult subjects with different anteroposterior and vertical skeletal patterns considering sex differences. The null hypothesis was that condylar size does not differ considerably among subjects with different anteroposterior and vertical skeletal patterns.

MATERIALS AND METHODS

Subjects

Three-dimensional scans of 332 TMJ of Japanese adults (61 men, mean age 27.2 $\pm$ 7.6 years; 105 women, mean age 27.4 $\pm$ 9.2 years) were retrospectively examined. They visited the Showa University Dental Hospital and consented to participation in the study. CBCT examination was carried out for all patients as part of the planning stage for orthodontic treatment. Subjects with congenital or systemic disease were excluded. Subjects had no symptoms of TMD, including joint pain, limited opening, or occurrence of joint sounds. Subjects with flattened condyles or osteophytes were also excluded. There were no evident mandibular deformities. None of the subjects had received orthodontic or orthopedic treatment. The study was approved by the Ethics Committee of Showa University.

Measurements

Lateral cephalograms were traced and Power Cephalo software (ReazaNet, Tokyo, Japan) was used to derive the measurements. The anteroposterior skeletal pattern was classified as skeletal Class I ($-1° \leq$ A point–nasion–B point angle (ANB) $< 4°$; 24 male subjects and 45 female subjects), Class II (ANB $\geq 4°$; 18 male subjects and 39 female subjects), or Class III (ANB $< -1°$; 19 male subjects and 21 female subjects).[6,7] The vertical skeletal pattern was classified as hypodivergent (mandibular plane angle [MP] $\leq 23°$; 13 male subjects and 13 female subjects), normodivergent ($23° <$ MP $< 30°$; 27 male subjects and 43 female subjects), or hyperdivergent (MP $\geq 30°$; 21 male subjects and 49 female subjects).[7]

Dental and maxillofacial CBCT images were acquired using a cone-beam X-ray CT system (CB MercuRay, Hitachi Medico Technology, Tokyo, Japan, and KaVo 3D eXam, KaVo, Biberach, Germany). The scanning conditions in the CB MercuRay CT system were 100 kVp, 10 mA, F-mode 512 slices/scan (slice width: 377 μm); the voxel size was 0.378 mm; and the acquisition time was 9.6 s. The scanning conditions in the KaVo 3DeXam CT system were 120 kVp, 5 mA, 432 slices/scan (slice width: 400 μm); the voxel size was 0.4 mm, and the acquisition time was 17.8 s. It has been confirmed that calibration between the two systems is unnecessary.[7] Data were stored in Digital Imaging and Communications in Medicine format and imported into Invivo 5 (Anatomage, San Jose, Calif) for further processing and analysis.

The condylar size on either side of the condyle was measured as described by Hilgers et al.[14] and Alkoshab et al.[15] The method used to assess condylar morphology was based on the delimitation and measurement of the distance between anatomical landmarks. The condylar length was determined by taking the posterior mandibular condyle point (PCo) and the anterior mandibular condyle point (ACo) on the front and rear sides 4 mm below the most superior mandible condyle point (SCo) and measuring the length of the line connecting them (Figure 1). The condylar height was determined by measuring the distance between the intersection point of a tangent from the most inferior point of the sigmoid notch (InfSig), parallel to the true horizontal line, in the sagittal plane and the posterior border of the ramus and the SCo (Figure 2). The medial mandible pole (MCo) and the lateral mandible pole (LCo) were determined corresponding to the largest dimension of the mandibular condyle in the coronal plane (Figure 3). Condylar width was determined by measuring the length of the line connecting the MCo and LCo in the coronal plane. The condylar length, height, and width

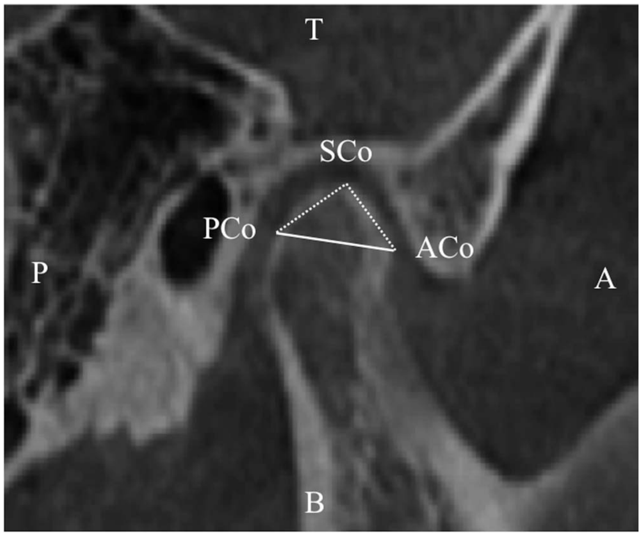

Figure 1. The condylar length on the sagittal cone-beam computed tomography image. A = anterior direction, P = posterior direction, T = top direction, B = bottom direction, SCo = the most superior mandibular condyle point, ACo = anterior mandibular condyle point, and PCo = posterior mandibular condyle point.

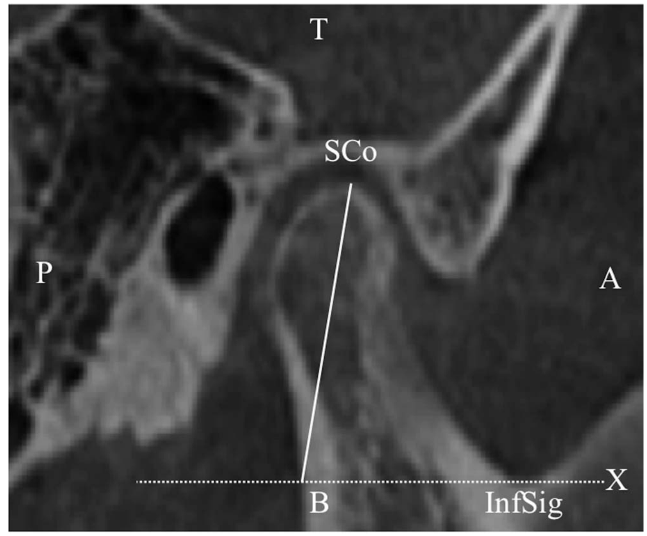

Figure 2. The condylar height on the sagittal CBCT image. A = anterior direction, P = posterior direction, T = top direction, B = bottom direction, SCo = the most superior condyle point, InfSig = the most inferior point of the sigmoid notch, X = tangent of the most inferior point of the sigmoid notch parallel to the true horizontal line.

were measured using CBCT images by one investigator.

Statistical Analysis

Thirty CBCT images were randomly chosen, and all measurements were re-evaluated in separate sessions at 2-week intervals under identical conditions by one investigator to assess intraoperator error. Measurement error was estimated according to Dahlberg's formula ($S2 = \Sigma d2/2n$).[16] The statistical significance of differences between the left and right sides in each measurement was determined using the Student's *t* test.

Analysis of covariance (ANCOVA) was used to compare the three measurements among anteroposterior skeletal patterns and among vertical skeletal patterns using sex as a covariate. Nine groups were further divided according to the anteroposterior and vertical groups, and two-way ANCOVA was used to estimate the composite effect of skeletal pattern in both directions. All statistical analyses were conducted using SPSS Statistics Version 23 (IBM Corporation, Armonk, NY), and Power calculation was conducted using Minitab 16 (Minitab, Inc., State College, PA). Statistical significance was defined at $P < .05$.

RESULTS

The intraobserver measurement errors for all three measurements were within 3%.[17] The left and right sides in all three measurements had no statistical difference.

Table 1 shows the descriptive statistics and ANCOVA results for the condylar size. Sex as a covariate showed statistical significance in seven among 12 examinations. Female condyles were smaller than the male ones. After adjusting for sex, the condylar height and the condylar width on both sides had statistical differences in the anteroposterior skeletal pattern ($P < .001$). The condylar height and width on both sides increased from Class II, Class I, and Class III. After adjusting for sex, the condylar width on both sides had statistical differences in the vertical skeletal pattern ($P < .001$). The condylar width on both sides increased from the hypodivergent, normodivergent, and hyperdivergent groups.

Table 2 shows the descriptive statistics for condylar size in the nine groups. Table 3 shows the ANCOVA results for condylar size to estimate the composite effect of skeletal patterns in both directions. The condylar height and width on both sides had statistically different anteroposterior and vertical skeletal patterns, respectively ($P < .01$ for both). No composite effect of skeletal patterns in both directions was observed.

Power calculation of this study was examined. In the anteroposterior skeletal patterns, the basic statistics of Class III as the largest average value and Class II as the smallest value were used to calculate the power using the unpaired *t*-test. The power of the right and left sides was 92% and 93%, respectively. In the vertical skeletal patterns, the basic statistics of hypodivergent for the right side and normodivergent for the left side were used as the largest average values, and hyper-

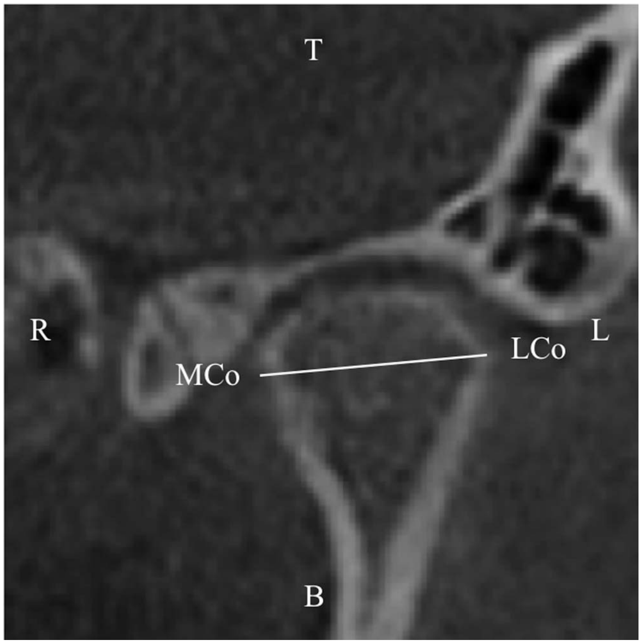

Figure 3. The condylar width on the coronal CBCT image. T = top direction, B = bottom direction, L = left direction, R = right direction, LCo = the most lateral mandibular condyle point, and MCo = the most medial mandibular condyle point.

divergent as the smallest value for both sides to calculate the power using the unpaired *t* test. The power was 47% and 78% on the right and left sides, respectively.

DISCUSSION

Condylar size was compared among different anteroposterior and vertical skeletal patterns using CBCT. The null hypothesis was that condylar size does not differ considerably according to the anteroposterior and vertical skeletal pattern. The condylar height and width differed considerably among subjects with different anteroposterior or vertical skeletal patterns. Therefore, the null hypothesis was rejected. Additionally, it was confirmed that condylar size had sex differences.

Condylar size measurements were determined based on the methods described by Hilgers et al.[14] and Al-koshab et al.[15] Al-koshab et al.[15] found that the similarity in measurements for Malays and Chinese may be due to their common origin. A similarity in the measurements for the Japanese subjects in this study and their subjects was found because both are East Asian populations. Therefore, the validity of the measuring method was confirmed. In contrast, there are no data obtained on another population with the same measuring method. The observation in different ethnicities would be interesting as well.

Park et al.[2] reported that hypodivergent and hyperdivergent groups showed significant differences in anteroposterior and mediolateral condyle widths (smaller in the hyperdivergent than in the hypodivergent groups). Their study included subjects with flattened condyles or osteophytes. Additionally, their statistical analysis combined both sexes. It has been reported that the frequency of osteophytes in the condyle may poorly correlate with age, sex, and dental and occlusal conditions.[18,19] To the contrary, there was a report that condyle size was larger in male subjects than in female subjects.[15] Female subjects had signs and symptoms of TMD more frequently than male subjects[20] and mandibular volume had sex differences.[7] Therefore, subjects with flattened condyles or osteophytes were excluded in the current study, and

Table 1. Descriptive Statistics and Analysis of Covariance Results for Condylar Size[a]

	Class I		Class II		Class III				
	Mean, mm	SE	Mean, mm	SE	Mean, mm	SE	*F*	*P*	Covariates
Condylar length L	8.70	0.166	8.72	0.212	9.01	0.203	0.936	.394	Sex*, Class*Sex*
Condylar length R	8.81	0.157	8.62	0.183	8.93	0.244	0.140	.869	Sex*, Class*Sex
Condylar height L	19.17	0.454	17.58	0.494	20.84	0.466	8.565	.000**	Sex, Class*Sex
Condylar height R	20.03	0.475	17.55	0.466	21.13	0.487	10.021	.000**	Sex, Class*Sex
Condylar width L	16.30	0.298	14.77	0.422	17.43	0.430	8.836	.000**	Sex**, Class*Sex
Condylar width R	16.54	0.312	15.04	0.398	17.32	0.398	7.151	.001**	Sex*, Class*Sex
	Hypodivergent		Normodivergent		Hyperdivergent				
	Mean, mm	SE	Mean, mm	SE	Mean, mm	SE	*F*	*P*	Covariates
Condylar length L	9.33	0.239	8.86	0.159	8.50	0.186	2.531	.083	Sex*, Class*Sex
Condylar length R	8.86	0.288	8.91	0.150	8.61	0.176	0.066	.936	Sex*, Class*Sex
Condylar height L	18.58	0.516	19.96	0.433	18.25	0.488	3.373	.037*	Sex, Class*Sex
Condylar height R	19.37	0.417	20.15	0.462	18.77	0.509	1.028	.360	Sex, Class*Sex
Condylar width L	17.58	0.432	16.83	0.332	14.69	0.340	13.563	.000**	Sex*, Class*Sex
Condylar width R	17.68	0.538	16.83	0.286	15.05	0.348	9.822	.000**	Sex, Class*Sex

[a] L indicates left side; R, right side; descriptive statistics for Means and SE (standard error); *F*, *F* statistics; *P*, *P* value; significantly associated variates.

$*P < 0.05$, $**P < 0.01$).

Table 2. Descriptive Statistics For Condylar Size In The 9 Groups[a]

		Condylar Length				Condylar Height				Condylar Width			
		L		R		L		R		L		R	
	n	Average	SD	Average	SD	Average	SD	Average	SD	Average	SD	Average	SD
Class I													
Hypodivergent	12	9.163	1.105	8.810	1.603	17.598	2.673	18.978	1.913	17.330	2.473	17.193	3.141
Normodivergent	32	8.630	1.227	8.950	1.297	19.335	3.670	20.071	4.071	16.414	2.299	16.576	2.022
Hyperdivergent	25	8.558	1.661	8.620	1.172	19.711	4.252	20.492	4.500	15.658	2.590	16.174	2.973
Class II													
Hypodivergent	6	9.717	1.432	9.385	1.193	17.848	2.350	18.075	2.365	16.405	1.452	17.610	2.304
Normodivergent	17	9.480	1.277	9.001	0.980	19.629	3.566	19.016	3.579	16.721	3.302	16.700	3.126
Hyperdivergent	34	8.157	1.569	8.297	1.501	16.502	3.635	16.728	3.476	13.500	2.742	13.752	2.327
Class III													
Hypodivergent	8	9.283	1.321	8.529	1.516	20.615	1.657	20.925	1.390	18.831	1.767	18.453	2.549
Normodivergent	21	8.692	1.430	8.764	1.427	21.185	3.456	21.201	3.666	17.566	2.979	17.309	2.92
Hyperdivergent	11	9.425	0.822	9.532	1.734	20.352	2.745	21.144	2.943	16.146	2.331	16.528	2.821

[a] L indicates left side; R, right side; *n*, number; SD, standard deviation.

sex was used as a covariate. Although sex as a covariate showed statistical significance in most examinations, the findings by Park and colleagues[2] were still replicated in this study.

Saccucci et al.[8] reported that the difference was not significant although Class III subjects tended to show a higher condylar volume and surface than Class I and Class II subjects. Katayama et al.[6] also reported no statistical difference in the mandibular volume among anteroposterior skeletal patterns. In the current study, a statistical difference in the condylar height and width was found among anteroposterior skeletal patterns. The difference in condylar size among anteroposterior skeletal patterns may be site specific.

Similar to the study conducted by Park et al.,[2] the current study also demonstrated that subjects with hyperdivergence had short condylar widths, whereas those with hypodivergence had large widths. Larger condylar volumes were reportedly a common characteristic of subjects with hypodivergence compared with subjects with normo- and hypodivergence.[8] Condylar volume and mandibular volumes had common characteristics in subjects with hypo- compared with those with normo- and hypodivergence.[7] The results of these studies, including the current study, were consistent. The masseter volume and thickness significantly correlate according to the vertical skeletal pattern.[21] Interestingly, positive correlations between masseter muscle weight and condylar size have been reported.[22] It has been shown that a significant relationship exists between masticatory muscle activity and vertical skeletal growth pattern.[23] The differences in masseter and medial pterygoid orientation and volume present in subjects with different underlying vertical skeletal patterns[24] may be important.

CONCLUSIONS

- Subjects with Class II or hyperdivergent skeletal patterns had small condylar sizes, and subjects with Class III or hypodivergent skeletal patterns had large condylar sizes.
- The anteroposterior and vertical skeletal patterns independently affected the condylar size.
- Female condylar sizes were smaller than those of males.

ACKNOWLEDGMENTS

We are deeply grateful to the subjects who participated in the present study. The authors would like to thank all participants in this study. This work was supported by KAKENHI Grant Numbers 17K11947. The authors would like to thank Enago (www.enago.jp) for the English language review. We also wish to

Table 3. Analysis of Covariance Results For Condylar Size[a]

	Class		Vertical		Interaction with Class and Vertical		
	F	*P*	*F*	*P*	*F*	*P*	Covariates
Condylar length L	1.008	.367	1.515	.223	3.093	.017*	Sex*, Class*Vertical*
Condylar length R	0.145	.865	0.010	.990	2.339	.058	Sex*, Class*Vertical
Condylar height L	5.093	.007**	2.186	.116	2.028	.093	Sex, Class*Vertical
Condylar height R	6.260	.002**	0.612	.544	1.274	.282	Sex*, Class*Vertical
Condylar width L	4.410	.014*	8.951	.000**	1.561	.187	Sex*, Class*Vertical
Condylar width R	2.277	.106	6.863	.001**	2.230	.068	Sex*, Class*Vertical

[a] L, left side; R, right side; *F*, *F* statistics; *P*, *P* value; significantly associated variates; $^{*}P < .05$; $^{**}P < .01$).

thank the Japan Institute of Statistical Technology (www.jiost.com) for the technical support and advice on statistical analyses.

REFERENCES

1. Moyers R. *Handbook of Orthodontics*. 4th ed. Chicago-London-Boca Raton: Year Book Medical Publishers Inc; 1988:183–195.
2. Park IY, Kim JH, Park YH. Three-dimensional cone-beam computed tomography based comparison of condylar position and morphology according to the vertical skeletal pattern. *Korean J Orthod*. 2015;45:66–73.
3. Gkantidis N, Halazonetis DJ, Alexandropoulos E, Haralabakis NB. Treatment strategies for patients with hyperdivergent Class II Division 1 malocclusion: is vertical dimension affected? *Am J Orthod Dentofacial Orthop*. 2011;140:346–355.
4. Katsavrias EG. Morphology of the temporomandibular joint in subjects with Class II Division 2 malocclusions. *Am J Orthod Dentofacial Orthop*. 2006;129:470–478.
5. Maki K, Inou N, Takanishi A, Miller AJ. Computer-assisted simulations in orthodontic diagnosis and the application of a new cone beam X-ray computed tomography. *Orthod Craniofac Res*. 2003;6:95–101.
6. Katayama K, Yamaguchi T, Sugiura M, Haga S, Maki K. Evaluation of mandibular volume using cone-beam computed tomography and correlation with cephalometric values. *Angle Orthod*. 2014;84:337–342.
7. Nakawaki T, Yamaguchi T, Tomita D, et al. Evaluation of mandibular volume classified by vertical skeletal dimensions with cone-beam computed tomography. *Angle Orthod*. 2016;86:949–954.
8. Saccucci M, Polimeni A, Festa F, Tecco S. Do skeletal cephalometric characteristics correlate with condylar volume. surface and shape? A 3D analysis. *Head Face Med*. 2012;8:15.
9. Al-Ekrish AA, Al-Juhani HO, Alhaidari RI, Alfaleh WM. Comparative study of the prevalence of temporomandibular joint osteoarthritic changes in cone beam computed tomograms of patients with or without temporomandibular disorder. *Oral Surg Oral Med Oral Pathol Oral Radiol*. 2015;120:78–85.
10. Cevidanes LH, Walker D, Schilling J, et al. 3D osteoarthritic changes in TMJ condylar morphology correlates with specific systemic and local biomarkers of disease. *Osteoarthritis Cartilage*. 2014;22:1657–1667.
11. Vitral RW, Telles Cde S. Computed tomography evaluation of temporomandibular joint alterations in class II Division 1 subdivision patients: condylar symmetry. *Am J Orthod Dentofacial Orthop*. 2002;121:369–375.
12. Goulart DR, Muñoz P, Olate S, de Moraes M, Fariña R. No differences in morphological characteristics between hyperplastic condyle and class III condyle. *Int J Oral Maxillofac Surg*. 2015;44:1281–1286.
13. Huang M, Hu Y, Yu J, Sun J, Ming Y, Zheng L. Cone-beam computed tomographic evaluation of the temporomandibular joint and dental characteristics of patients with Class II subdivision malocclusion and asymmetry. *Korean J Orthod*. 2017;47:277–288.
14. Hilgers ML, Scarfe WC, Scheetz JP, Farman AG. Accuracy of linear temporomandibular joint measurements with cone beam computed tomography and digital cephalometric radiography. *Am J Orthod Dentofacial Orthop*. 2005;128:803–811.
15. Al-koshab M, Nambiar P, John J. Assessment of condyle and glenoid fossa morphology using CBCT in South-East Asians. *PLoS One*. 2015;10:e0121682.
16. Dahlberg G. Statistical methods for medical and biological students. *Br Med J*. 1940;2:358–359.
17. Midtgård J, Björk G, Linder-Aronson S. Reproducibility of cephalometric landmarks and errors of measurements of cephalometric cranial distances. *Angle Orthod*. 1974;44:56–61.
18. Takayama Y, Miura E, Yuasa M, Kobayashi K, Hosoi T. Comparison of occlusal condition and prevalence of bone change in the condyle of patients with and without temporomandibular disorders. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod*. 2008;105:104–112.
19. Grossmann E, Remedi MP, Ferreira LA, Carvalho AC. Magnetic resonance image evaluation of temporomandibular joint osteophytes: influence of clinical factors and artrogenics changes. *J Craniofac Surg*. 2016;27:334–338.
20. Mohlin B, Axelsson S, Paulin G, et al. TMD in relation to malocclusion and orthodontic treatment. *Angle Orthod*. 2007;77:542–548.
21. Biondi K, Lorusso P, Fastuca R, et al. Evaluation of masseter muscle in different vertical skeletal patterns in growing patients. *Eur J Paediatr Dent*. 2016;17:47–52.
22. Liu ZJ, King GJ, Herring SW. Alterations of morphology and microdensity in the condyle after mandibular osteodistraction in the rat. *J Oral Maxillofac Surg*. 2003;61:918–927.
23. Alabdullah M, Saltaji H, Abou-Hamed H, Youssef M. Association between facial growth pattern and facial muscle activity: a prospective cross-sectional study. *Int Orthod*. 2015;13:181–194.
24. Wong A, Woods MG, Stella D. Three-dimensional computed tomographic assessment of mandibular muscles in growing subjects with different vertical facial patterns. *Aust Orthod J*. 2016;32:2–17.