Original Article

Association of the three-dimensional skeletal variables with self-recognition of facial asymmetry in skeletal Class III patients

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ABSTRACT

Objectives: To investigate the association between three-dimensional (3D) skeletal variables and self-recognition of facial asymmetry in skeletal Class III patients.

Materials and Methods: Questionnaires and cone beam computed tomography of 74 patients (42 men and 32 women; mean age: 22.8 $\pm$ 4.5 years) with skeletal Class III and facial asymmetry were collected retrospectively. Patients were classified into three groups: group Sy (recognition of symmetry), group NS (not sure), and group Asy (recognition of asymmetry), according to their responses to the questionnaires. To assess 3D anatomic differences in the maxillomandibular region, six 3D hard tissue variables: maxillary height, ramal length, frontal ramal inclination (FRI), lateral ramal inclination (LRI), mandibular body length (Mn BL), and mandibular body height (Mn BH) were compared among the three self-recognition groups. Six 3D hard tissue variables and Menton deviation were reduced into three factors and their association with the self-recognition of facial asymmetry was investigated.

Results: Maxillary height, FRI, LRI, Mn BH, and Menton deviation demonstrated significant differences among the three self-recognition groups. The reduced factors, which consisted of transverse and vertical parameters, and vertical parameter of the mandibular corpus, demonstrated significant differences among the three self-recognition groups. The difference in Mn BH influenced the self-recognition of facial asymmetry.

Conclusions: Both the transverse and vertical parameter of the skeleton were determinant in self-recognition of facial asymmetry. Identification of the skeletal difference in the lateral view involving LRI and Mn BH should be included for assessment of facial asymmetry. (*Angle Orthod.* 2022;92:512–520.)

KEY WORDS: Skeletal Class III; Facial asymmetry; Self-recognition

INTRODUCTION

As the interest and desire for an attractive facial appearance have increased in Korean society, many people seek esthetic improvement of the dentofacial region since it contributes significantly to overall facial appearance. Orthodontic treatment is considered one of the main dental procedures for esthetic improvement.[1,2] Facial symmetry and proportionality should be taken into consideration when selecting the optimal treatment modality, since not only accom-

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Table 1. Description of the Subjects Used in this Study (n = 74)[a]

Age, Mean ± SD, y	Sex (%) Female	Sex (%) Male	Menton Deviation Mean ± SD (°)	ANB Difference Mean ± SD (°)
22.8 ± 4.5	32 (43.2)	42 (56.8)	4.4 ± 3.2	−1.91 ± 2.53

[a] n indicates number; SD, standard deviation.

plishment of ideal occlusion but also achieving harmonious facial appearance is the goal of orthodontic treatment.[3,4] Therefore, orthosurgical treatment is performed for people concerned with facial imbalances such as prognathism, retrognathism, and asymmetry.[5,6] In Korea, orthosurgical treatment is frequently conducted in patients with skeletal Class III malocclusion since mandibular prognathism is prevalent in Asian population.[7] Their concurrent facial asymmetry is frequently requested to be corrected along with their surgical treatment.[8,9] However, clinicians sometimes experience a situation of inconsistent recognition of facial asymmetry. Some patients with mild asymmetry, which can be unnoticeable to the clinician, consider it severe and demand surgical correction. In contrast, others do not recognize their facial asymmetry at all even when it is beyond acceptable variation. This embarrassing situation implies that the patient's subjective self-recognition of facial asymmetry in addition to the anatomic or academic criterion should be considered when determining the treatment option.[10–13]

Conventional methods of evaluating facial asymmetry were mainly focused on the lip area with two-dimensional (2D) facial photographs, or skeletal analysis with perspective projection of a posteroanterior cephalogram.[10–14] However, cone-beam computed tomography (CBCT) enabled the acquisition of 3D images of the maxillofacial skeleton with lower radiation than multi-detector computed tomography.[15] Accordingly, software with an easy and convenient interface has been commercialized and widely adopted by many clinicians. Hence, investigation of the 3D skeletal variables that are related to the self-recognition of facial asymmetry would be helpful to identify the underlying cause of the patient's self-recognition of facial asymmetry and to make clinical decisions. However, the association of the 3D skeletal variables with the self-recognition of facial asymmetry has never been reported. Therefore, the objective of this study was to investigate retrospectively the association of 3D skeletal variables with self-recognition of facial asymmetry in skeletal Class III patients. The null hypothesis of this study was that there would be no association between the 3D skeletal variables and self-recognition of facial asymmetry in skeletal Class III patients.

MATERIALS AND METHODS

Subject

Questionnaires and CBCT data of patients who visited Chonnam National University Dental Hospital were retrospectively reviewed. The inclusion criteria were: (1) skeletal Class III defined by an ANB difference less than 0° in lateral cephalograms; (2) facial asymmetry defined by an angle of more than 2° of Menton deviation between the midsagittal reference plane (plane consists of crista-galli [Cg], anterior nasal spine [ANS], and the opisthion [Op]) and a line connecting ANS and Menton in the CBCT image on frontal view; and (3) young adults over 18 years of age. Patients with craniofacial disorders and those with history of previous orthodontic and/or orthognathic treatment were excluded. A total of 74 patients (42 males and 32 females; mean age: 22.8 years) were enrolled (Table 1). A power analysis using G*Power software (version 3.1.3; Franz Faul University, Kiel, Germany) determined that a sample size of 74 would provide a power of 80% to detect an effect size of 0.37 at a level of significance of $\alpha = .05$. The CBCT images were obtained for orthognathic evaluation of the skeletal Class III patients. This study was reviewed and approved by the Institutional Review Board of the Chonnam National University Dental Hospital in Gwangju, Korea (No. CNUDH-2021-005).

Evaluation of Self-Recognition of Facial Asymmetry

To evaluate self-recognition of facial asymmetry, the subjects were asked to answer questionnaires at their initial visit (Table 2). The first question was regarding whether patients recognized their asymmetry and the severity of the recognition was rated from 1 (sure of symmetry) to 5 (sure of asymmetry). Ratings of 1 and 2 indicated that the subjects did not consider themselves to have facial asymmetry, while the ratings of 4 and 5 indicated that the subjects considered themselves to have facial asymmetry. The rating of 3 indicated that the subjects were not sure about their facial asymmetry. The second question was related to the recognized side of the chin point deviation. Ratings of 1 and 2 indicated that the subjects recognized their chin point was deviated

Table 2. Questionnaire Used to Investigate Patients' Self-Recognition of Facial Asymmetry

Please answer the following questions if you think you have facial asymmetry or not. You can use a handheld mirror.

1. When you see your facial area of the upper and lower jaws, do you think that you have facial asymmetry?
   ① I'm sure that my face is symmetrical.
   ② I don't think I have facial asymmetry.
   ③ I'm not sure.
   ④ I think I have facial asymmetry.
   ⑤ I'm sure that my face is asymmetrical.

If you answered number 4 or 5 of the question above, please answer the following questions regarding the side of chin point deviation.

2. If you think you have a facial asymmetry, to which side do you think your chin is deviated?
   ① Obviously, my chin is deviated to the right side.
   ② I think that my chin is deviated to the right side.
   ③ I'm not sure.
   ④ I think that my chin is deviated to the left side.
   ⑤ Obviously, my chin is deviated to the left side.

to the right side, while ratings of 4 and 5 indicated that their chin point was deviated to the left side. The rating of 3 indicated that the subjects were not sure about the direction of the deviation.

On the basis of the first question, patients were classified into three self-recognition groups: group Sy (recognition of symmetry), group NS (not sure), group Asy (recognition of asymmetry).

Measurements of the Six 3D Hard-Tissue Variables

CBCT data (Alphard Vega; Asahi Roentgen, Kyoto, Japan; 80 kV and 5 mA; voxel size, 0.39 mm × 0.39 mm × 0.39 mm; and field of view, 200 mm × 179 mm) were imported to Invivo5 software (version 5.1, Anatomage, San Jose, CA, USA) for reconstruction of the 3D volume rendered image. Using the 3D Analysis module of Invivo5 software, six 3D hard-tissue variables were measured, which were suggested to be related to facial asymmetry (Figure 1).[16] First, three reference planes were constructed on the 3D volume image. The midsagittal reference plane (MSR plane) was constructed by Cg, ANS, and Op. The horizontal reference plane of the cranium was constructed by connecting the right orbitale and both porions (Frankfurt Horizontal [FH] plane). In addition, the horizontal reference plane of the mandible (mandibular plane) was constructed by connecting both sides of antegonion (Ag) and Menton (Figure 2 and Table 3).

The maxillary height was measured using the perpendicular distance from M point to the FH plane. In the mandible, five variables were measured: (1) Ramus length (RL): Cd_{sup}-Go_{inf}, the 3D distance between the superior point of the condylar head and the inferior point of the gonion area (mm); (2) frontal ramal inclination (FRI): Cd_{lat}-Go_{lat} to the MSR plane, the angle formed by the MSR plane and the external

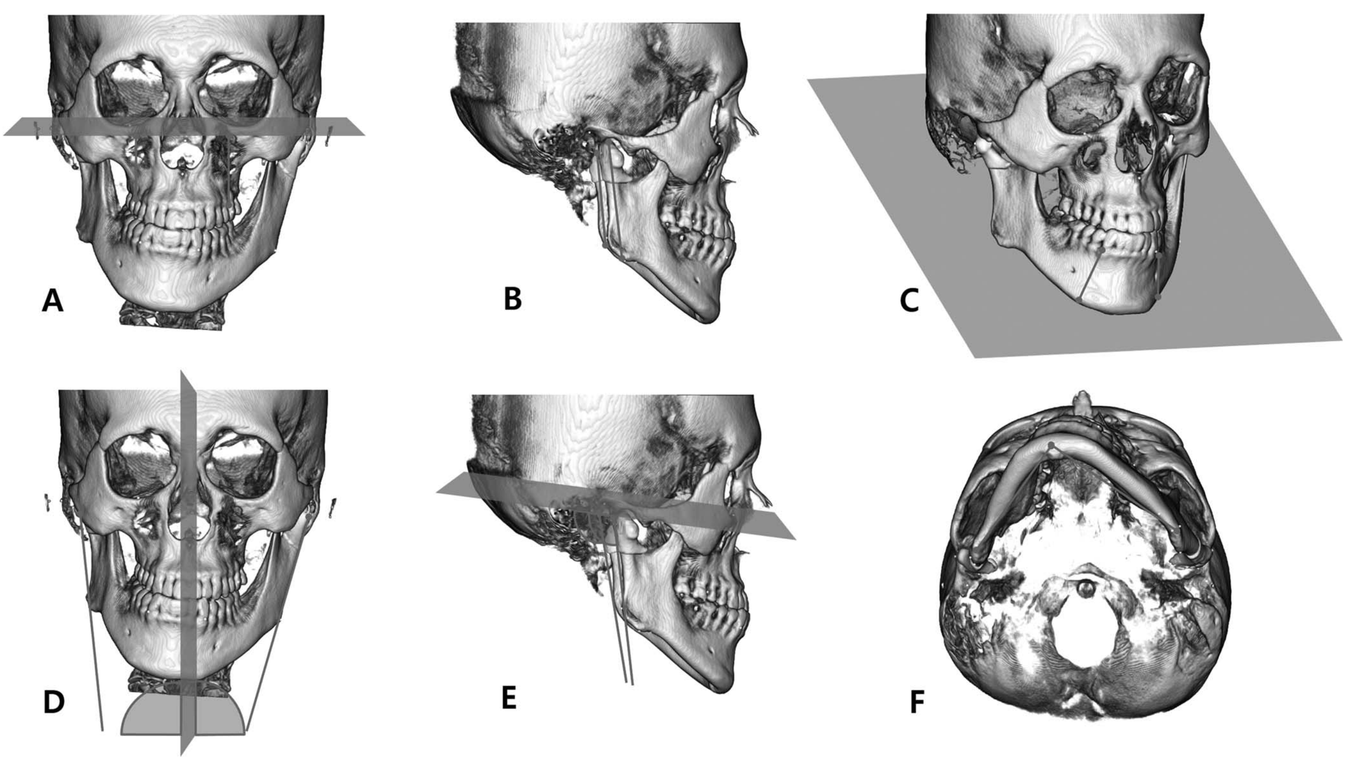

Figure 1. Six 3-dimensional hard tissue variables: (A) maxillary height; (B) ramus length; (C) mandibular body height; (D) frontal ramal inclination; (E) lateral ramal inclination; (F) mandibular body length.

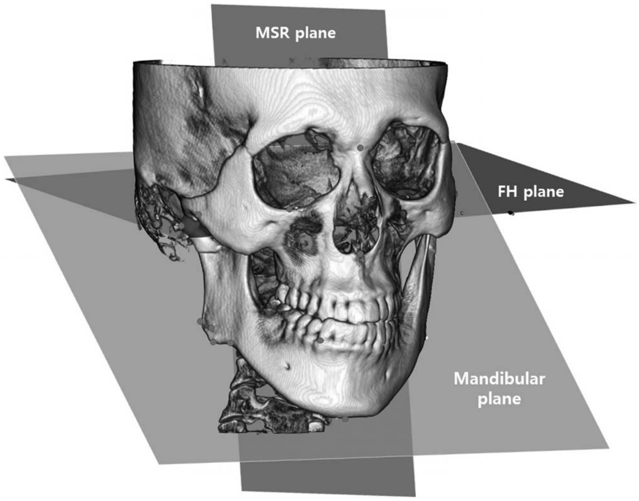

Figure 2. Three reference planes: (FH plane: Frankfort horizontal plane; MSR plane: midsagittal reference plane; and mandibular plane) and digitized landmarks (dots; see Table 3).

border of the ramus in the frontal view (°); (3) lateral ramal inclination (LRI): Cd_{post}-Go_{post} to the FH plane, the angle formed by the FH plane and the posterior border of the ramus in the sagittal view (°); (4) mandibular body length (Mn BL): Me-Go_{post}, the 3D distance between the Menton and the most posterior point of the gonion area (mm); and (5) mandibular body height (Mn BH): Canine to mandibular plane, the perpendicular distance from the labial marginal bone of the mandibular canine to the mandibular plane (mm) (Figures 1 and 2, Table 3).

Statistical Analysis

The demographic and clinical characteristics of the three self-recognition groups were compared with Chi-square test and Kruskal-Wallis test.

Paired *t*-test was performed to assess differences between the deviated and nondeviated sides of the six 3D hard-tissue variables after normal distribution of the six 3D hard-tissue variables was confirmed by the Shapiro-Wilk test. Analysis of variance (ANOVA) with post-hoc Tukey test was performed to evaluate the differences in the six 3D hard-tissue variables and Menton deviation among the three self-recognition groups.

In addition, the six 3D hard-tissue variables and Menton deviation were collated into three factors using factor analysis, each comprising a combination of the original variables. ANOVA with post-hoc Tukey test was performed to compare the three factors among the three self-recognition groups. Multinominal logistic regression analysis was performed to identify the association between the reduced factors and the self-recognition of facial asymmetry. All statistical analyses

Table 3. Landmarks Used in this Study

Landmarks	Abbreviation	Description
Crista galli	Cg	Most superior point of the crista galli of the ethmoid bone
Opisthion	Op	Most posterior point on the posterior margin of the foramen magnum
Porion	Po	Highest point on the roof of the external auditory meatus
Orbitale	Or	Lowest point on the infraorbital margin
Condylion superius	Cd_{sup}	Most superior point of the condyle head
Condylion medialis	Cd_{med}	Most medial point of the condyle head
Condylion lateralis	Cd_{lat}	Most lateral point of the condyle head
Gonion lateralis	Go_{lat}	Most lateral point of the gonion area
Gonion posterius	Go_{post}	Most posterior point of the gonion area
Gonion inferius	Go_{inf}	Most inferior point of the gonion area
Antegonion	Ag	Deepest point of the antegonial notch of the mandible
Menton	Me	Most inferior point on the mandibular symphysis
Molar point	M point	Most inferior point of the buccal marginal bone of the maxillary first molar in the frontal view
Canine	Canine	Most superior point of the labial marginal bone of the mandibular canine in the frontal view

were performed using Python (version 3.6.9, Python Software Foundation, Montreal, Canada).

RESULTS

Demographic and Clinical Characteristics

The distribution of the study population of the three self-recognition groups is presented in Table 4. Exactly 37.8% of the subjects answered that they recognized their facial asymmetry and, in these subjects, the recognized side of the chin point deviation corresponded to the side determined by CBCT; 25.7% of the subjects answered that they did not recognize their facial asymmetry; and 36.5% of the subjects were not sure about their facial asymmetry, despite all the subjects demonstrating a Menton deviation of more than 2.0°. There were no significant differences in the distribution of subjects and sex, mean age, and ANB difference among the three groups.

Six 3D Hard-Tissue Variables

The 3D hard-tissue variables of the deviated and nondeviated sides in all subjects are presented in Table 5. The values of the maxillary height, RL, FRI,

Table 4. Characteristics of Three Self-Recognition Groups of Facial Asymmetry[a–c]

	Group Sy	Group NS	Group Asy	*P* Value
Number of subjects, n (%)	19 (25.7%)	27 (36.5%)	28 (37.8%)	.373[b]
Sex				
Female, n (%)	6 (31.5%)	12 (44.5%)	14 (50%)	.452[b]
Male, n (%)	13 (68.5%)	15 (55.5%)	14 (50%)	
Age (y)	21.11 ± 3.16	23.80 ± 5.38	24.03 ± 3.91	.056[c]
ANB difference (°)	−2.11 ± 2.87	−2.00 ± 2.83	−1.81 ± 2.04	.912[c]

[a] Asy, indicates recognition of asymmetry; NS, nonsignificant; Sy, recognition of symmetry.
[b] Square-Chi goodness of fit test was performed.
[c] Kruskal-Wallis test was performed.

LRI, and Mn BL of the nondeviated side were greater than that of the deviated side, and the differences were significant (all $P < .001$). However, the value of the Mn BH of the nondeviated side was smaller than that of the deviated side, although this difference was not significant ($P = .053$). The skeleton involved with maxillary height, RL, FRI, LRI, and Mn BL of the nondeviated side demonstrated more development than that of the deviated side, while the Mn BH did not.

Comparison of Six 3D Hard-Tissue Variables and Menton Deviation Among Three Self-Recognition Groups

The differences of the six 3D hard tissue variables and Menton deviation among the three self-recognition groups are presented in Table 6. The Menton deviation was presented as the absolute value irrespective of the deviated side, which demonstrated the most significant difference among the three groups ($P < 0$). The post-hoc analysis revealed that the significance was attributed to the difference of group Asy with both group NS and group Sy (Figure 3). This result might confirm that the Menton deviation is not only a reliable diagnostic variable but also a determinant factor in recognition of facial asymmetry.

The maxillary height, FRI, LRI, and Mn BH demonstrated significant differences among the three self-recognition groups (Table 6), which were all related to group Asy (Figure 3). No significant differences were revealed in variables between group NS and group Sy. In the maxillary height, FRI, and Mn BH, the difference between group NS and group Asy contributed the significance, while the difference between group Sy and group Asy was in the LRI (Figure 3). The Mn BH of group Sy and Asy demonstrated more development on the deviated side than that of the nondeviated side, which was an opposite tendency compared with other 3D variables (Table 6). There were no significant differences in RL and Mn BL among the three self-recognition groups (Table 6 and Figure 3).

Factor Analysis and Comparison of the Factors Among Three Self-Recognition Groups

Using factor analysis, the six 3D hard-tissue variables and Menton deviation were reduced to three factors (Table 7). Each factor was a combination of the original variables that represented the directional growth pattern of the maxillomandibular structures. As a result, the factors were matched with the transverse and vertical parameters, and vertical parameter of the mandibular corpus (Figure 4).

All three factors demonstrated significant differences among the three self-recognition groups (Table 8). The post-hoc analysis revealed that the significance of factor 1 and 2 were attributed to differences of group Asy with both group Sy and group NS, while factor 3 was the difference of group Asy and group NS. No significant differences were revealed between group NS and group Sy in all factors (Figure 5).

Table 5. Comparison of Six 3D Hard-Tissue Variables Between Deviated and Nondeviated Sides[a,b]

	Deviated Side	Nondeviated Side	Difference[c]	
Variables	Mean ± SD	Mean ± SD	Mean ± SD	*P* Value
Maxillary height	42.71 ± 5.69	44.14 ± 5.70	−1.43 ± 1.87	<0***
Ramus length	66.73 ± 7.98	69.70 ± 7.92	−2.97 ± 4.24	<0***
Frontal ramal inclination	10.50 ± 4.08	13.45 ± 4.56	−2.94 ± 4.14	<0***
Lateral ramal inclination	100.91 ± 5.75	103.17 ± 5.82	−2.27 ± 3.24	<0***
Mandibular body length	93.82 ± 5.88	96.23 ± 6.31	−2.41 ± 3.18	<0***
Mandibular body height	31.14 ± 4.55	30.85 ± 4.81	0.29 ± 1.29	.053

[a] Paired *t*-test was performed.
[b] SD indicates standard deviation; *** $P < .001$.
[c] A positive number indicates that the value of the deviated side is greater than that of the nondeviated side; a negative number indicates the value of the deviated side is less than that of the nondeviated side.

Table 6. Comparison of Six 3D Hard-Tissue Variables and Menton Deviation Among Three Self-Recognition Groups[a–c]

	Group Sy	Group NS	Group Asy	
Variables	Mean ± SD	Mean ± SD	Mean ± SD	*P* Value
Maxillary height diff.	−1.33 ± 1.27	−0.66 ± 1.54	−2.24 ± 2.13	.006**
Ramus length diff.	−2.29 ± 2.46	−2.20 ± 4.18	−4.17 ± 4.86	.163
Frontal ramal inclination diff.	−2.20 ± 2.16	−1.50 ± 3.51	−4.84 ± 4.89	.006**
Lateral ramal inclination diff.	−0.40 ± 1.83	−2.18 ± 3.08	−3.61 ± 3.42	.003**
Mandibular body length diff.	−1.03 ± 2.38	−2.48 ± 2.82	−3.27 ± 3.57	.056
Mandibular body height diff.	0.41 ± 0.94	−0.27 ± 1.48	0.76 ± 1.05	.010*
Menton deviation	2.84 ± 1.08	3.56 ± 2.47	6.27 ± 3.86	<0***

[a] Asy indicates recognition of asymmetry; diff, difference; NS, nonsignificant; SD, standard deviation, Sy, recognition of symmetry.
[b] Analysis of variance was performed.
[c] A positive number indicates that the value of the deviated side is greater than that of the nondeviated side; a negative number indicates the value of the deviated side is less than that of the nondeviated side.
* $P < .05$; ** $P < .01$; *** $P < .001$.

Association of Factors With Self-Recognition of Facial Asymmetry

Multinominal logistic regression models were derived to examine the effect of the three factors on the self-recognition of facial asymmetry. The odds ratio (OR) that shows the probability of change in self-recognition of facial asymmetry from group NS to group Sy or group Asy is presented in Table 9. The results demonstrated a 2.5-fold increase in the odds for recognition of asymmetry (Group Asy) compared to the not sure of asymmetry (group NS) when factor 3 demonstrated bilateral difference (OR, 2.5; $P = .005$).

DISCUSSION

Symmetry has been considered one of the main factors of facial attractiveness.[17,18] Many previous studies revealed that self-recognition of facial asymmetry was dependent on various features.[16–20] Also, it was demonstrated that differences in perception of facial asymmetry existed between dentists and patients.[9] However, there were few studies about the relationship between self-recognition of facial asymmetry and 3D analysis of the hard tissue, which is now widely implemented when diagnosing orthodontic patients.

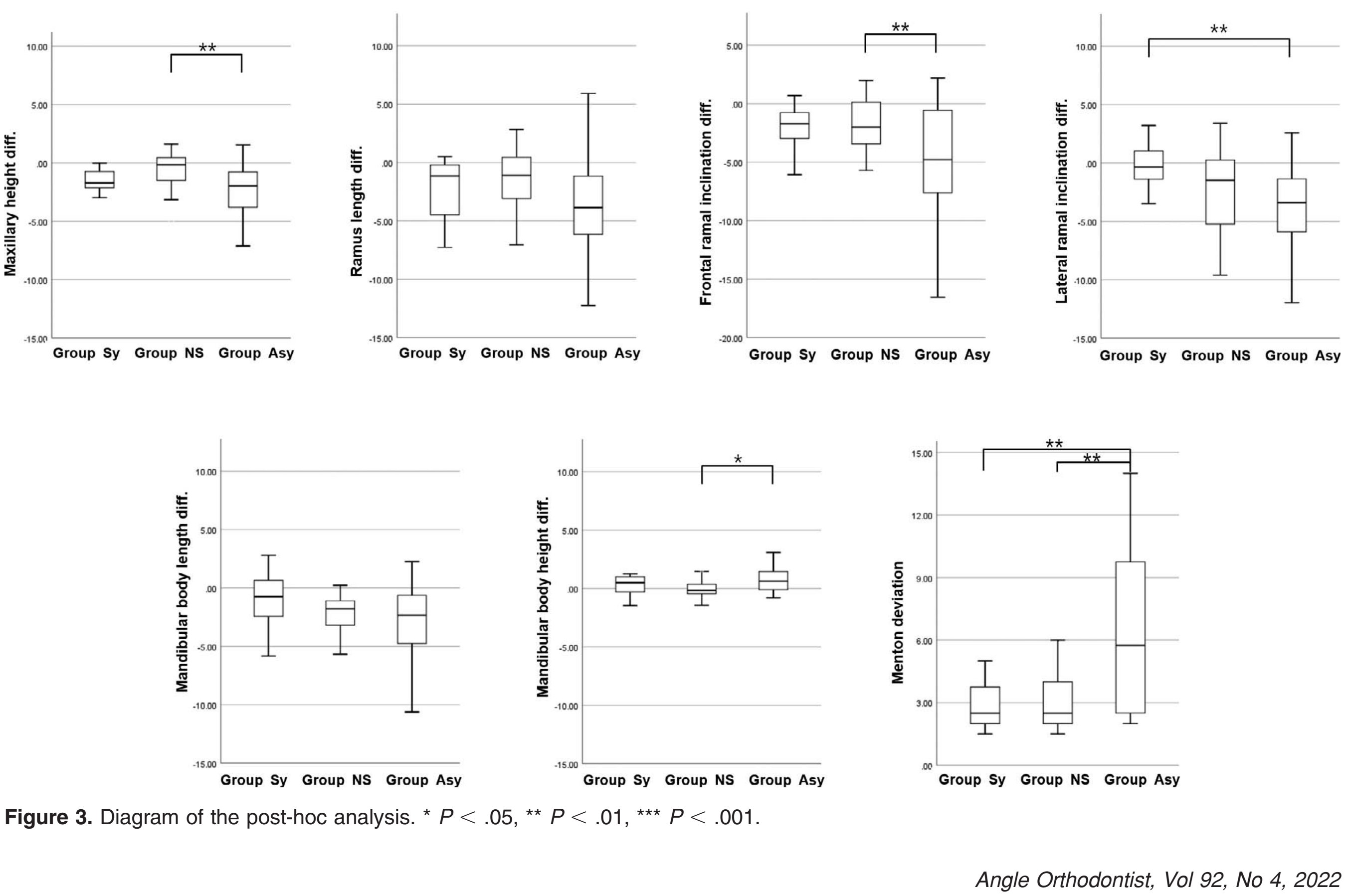

Figure 3. Diagram of the post-hoc analysis. * $P < .05$, ** $P < .01$, *** $P < .001$.

Table 7. Variance Explained by Three Extracted Factors[a,b]

Variables	Factor 1	Factor 2	Factor 3
Maxillary height diff.	0.134	**0.764**	−0.017
Ramal height diff.	0.206	**0.652**	0.050
Frontal ramal inclination diff.	0.209	**0.450**	−0.068
Lateral ramal inclination diff.	**0.474**	0.123	0.121
Mandibular body length diff.	**0.596**	0.160	0.029
Mandibular body height diff.	0.083	−0.038	**0.994**
Menton deviation	**−0.905**	−0.330	0.094

[a] diff. indicates difference.
[b] The bold letters indicate significant relevance within the factor in the same row.

Table 8. Comparison of the Three Factors Among the Three Self-Recognition Groups[a,b]

	Group Sy		Group NS		Group Asy		
	Mean	SD	Mean	SD	Mean	SD	*P* Value
Factor 1	−4.45	2.73	−6.61	5.36	−11.44	6.33	0***
Factor 2	−4.66	3.02	−4.45	5.07	−9.68	6.1	0***
Factor 3	0.66	1.01	−0.27	1.54	0.97	1.34	.004**

[a] Asy indicates recognition of asymmetry; NS, non-significant; SD, standard deviation; Sy, recognition of symmetry.
[b] Analysis of variance was performed.
*** $P < .001$; ** $P < .01$.

To assess the self-recognition of facial asymmetry, three self-recognition groups were formed according to the response of the questionnaire. The Menton deviation demonstrated a significant difference among the three groups (Table 6). The mean Menton deviations of the groups Sy and NS were 2.84° and 3.56°, while it was 6.27° in group Asy. This confirmed that Menton deviation was an important determining factor in self-recognition of facial asymmetry.[14] Among the six 3D hard-tissue variables, the maxillary height, FRI, LRI, and Mn BH demonstrated significant differences among the three groups (Table 6). However, the significant difference between group Asy and Sy was found only in LRI, which could mean that the LRI difference might be a determinant in recognition of facial asymmetry (Figure 3).

For effective and intuitive prediction, the six 3D variables and Menton deviation were reduced into factors (Table 7). The results showed that factors 1 and 2 were related to the transverse and vertical parameters, respectively (Figure 4). The variables collated into factors 1 and 2 demonstrated more development on the nondeviated side than the deviated side (Table 5). However, the variable which was not collated with any other variables was Mn BH. The reason might be the opposite growth tendency of the Mn BH, with more development on the deviated side than the non-deviated side associated with a separate reference plane, the mandibular plane (Table 5). Therefore, factor 3 was named as the 'vertical parameter of the mandibular corpus' to distinguish growth of the body area from that of ramal area.

All 3 factors demonstrated significant differences among the 3 self-recognition groups. F1 and factor 2 demonstrated differences of group Asy with both group NS and group Sy, which indicated that both vertical and transverse parameters of the skeleton was determinant in recognition of facial asymmetry. Factor 3, Mn BH, showed a difference between group NS and group Asy. In addition, Mn BH demonstrated significant

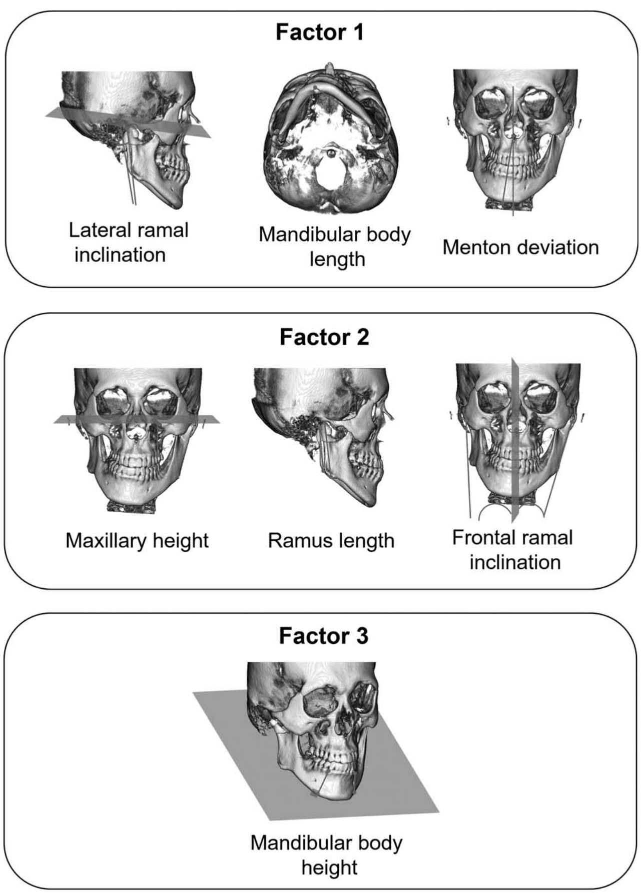

Figure 4. Result of factor analysis.

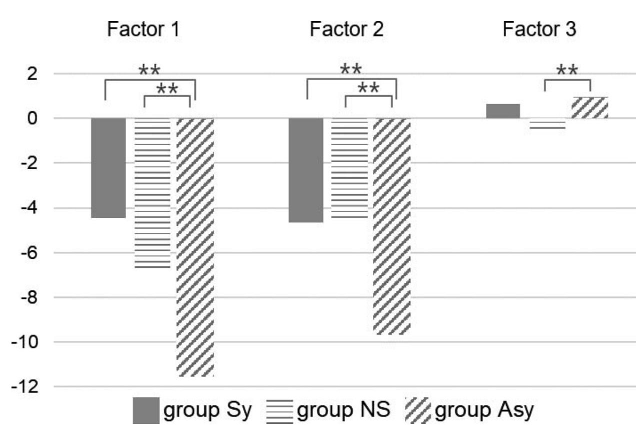

Figure 5. Diagram of the post-hoc analysis. ** $P < 0.01$.

Table 9. Multinominal Logistic Regression for the Effect of the Three Factors on the Self-Recognition of Facial Asymmetry[a,b]

	Group Sy		Group Asy	
	OR (lower limit, upper limit of 95% CI)	*P* Value	OR (lower limit, upper limit of 95% CI)	*P* Value
Factor 1	1.36 (−0.019, 0.633)	.065	0.88 (−0.359, 0.094)	.251
Factor 2	0.79 (−0.497, 0.038)	.093	0.88 (−0.343, 0.076)	.212
Factor 3	1.92 (−0.078, 1.378)	.080	2.50 (0.273, 1.562)	.005**

[a] Asy indicates recognition of asymmetry; CI, confidence interval; OR, odds ratio; Sy, recognition of symmetry.
[b] Multinominal logistic regression analysis was performed.
** $P < .01$.

effects on the self-recognition of facial asymmetry in the multinominal logistic regression models (Table 9). The greater Mn BH on the deviated side than the nondeviated side, which might appear as a bulky mandibular border on the deviated side, the more probability of recognition of an asymmetric face (group Asy) compared to recognition of not sure (group NS). This result could be explained with cognitive psychology that a slightly rotated face is preferred and better recognized than a frontal face.[21,22] Contemporary trends also show that the rotated face is recognized as the most attractive and preferred to take selfie photos from a social network service.[23] A previous investigation also reported that a 45° oblique view received more focused when looking at a person's face using the eye tracking method.[24] Therefore, evaluation of the lateral facial appearance should be included for evaluating self-recognition of facial asymmetry. Conventionally, clinicians have evaluated frontal view parameters such as maxillary height difference or occlusal plane cant and Menton deviation for the assessment of facial asymmetry.[13,14] However, results of this study indicated that initial diagnosis should include additional identification of the skeleton in the laterally rotated view involving LRI and Mn BH.

Nevertheless, there were several limitations to this study. Validated questionnaires need to be used to give more meaningful results about the self-recognition of facial asymmetry. Since a limited number of variables were analyzed, more 3D variables need to be adopted to derive more clinically meaningful results. In addition, given that the recognition of facial asymmetry is affected by soft tissue as well as hard tissue, it is hoped that 3D research will be conducted considering both.

CONCLUSIONS

Within the limitations of this study:

- Menton deviation is not only a reliable diagnostic variable but also a determinant factor in recognition of facial asymmetry.
- Transverse and vertical parameters of the skeleton were determinant in self-recognition of facial asymmetry.
- Identification of the skeletal difference in the lateral view involving LRI and Mn BH should be included in the assessment of facial asymmetry.

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