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Comparison of cephalometric variables between adult Spanish and Japanese women with Class I malocclusion

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Abstract:

OBJECTIVE: To our knowledge, no study has compared the facial and dental morphology of adult Latin and Japanese populations. The purpose of this study was to assess differences in the facial and dental morphology between adult Spanish and Japanese women with Class I malocclusion using lateral cephalograms.

MATERIALS AND METHODS: The lateral cephalograms of 33 adult Spanish and 33 adult Japanese women were traced and digitized by a single investigator. All patients satisfied the following criteria: female sex; age 18–35 years; skeletal Class I malocclusion (ANB angle, 2°–5°; angle Class I malocclusion; arch length discrepancy, –10 to + 10 mm; overjet, 1–5 mm; overbite, 1–5 mm); absence of congenital anomalies, significant facial asymmetry, or congenitally missing teeth, with the exception of the third molars; significant temporomandibular joint problems; severe crowding; and no history of orthodontic treatment.

RESULTS: Eleven and six angular measurements for the skeletal and dental hard tissues, respectively, were computed in accordance with previous studies. The results showed that Japanese women had significant maxillary and mandibular protrusion, clockwise mandibular rotation, greater labial tipping of incisors, and a smaller interincisal angle compared with Spanish women.

CONCLUSION: At the time of orthodontic treatment planning, it is important to consider the facial and dental morphological characteristics of individual ethnic groups to achieve satisfactory outcomes and retention. The findings of this study provide valuable information that will aid in orthodontic treatment planning for adult Spanish and Japanese women.

Keywords:

Cephalometric analysis, ethnic groups, Japanese, malocclusion, Spanish

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Introduction

Internationalization has recently progressed, and various racial or ethnic groups now live in different metropolitan areas worldwide. Because of the coexistence of different ethnicities, craniofacial surgeons and other medical professionals need to recognize the facial and dental morphological characteristics of individual ethnic groups to analyze and correct disfigurements and anomalies in the

head and face regions.^[1,2] In the field of orthodontics, facial balance and harmony are essential to achieve successful retention after orthodontic treatment and following a single standard for facial esthetics, while making orthodontic diagnoses and planning treatments for patients from various ethnic backgrounds may not be appropriate.

Lateral cephalograms have been used for the analysis of craniofacial structures in the field of orthodontics for several years. Numerous studies have shown differences in the dentofacial morphology among different ethnic groups, and many cephalometric

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standards have been established for different ethnicities. Therefore, before orthodontic treatment planning, it is important to consider the norms for the ethnic group to which the patient belongs.^[3-22]

Several studies have compared the lateral cephalograms of adult Caucasian and Mongoloid patients and have shown that the direction of facial growth is more vertical and the dentition is more protrusive in the Japanese than in Caucasians.^[6,17,19-21] However, the Caucasian and Mongoloid populations are subdivided into several ethnicities, and to the best of our knowledge, no study has performed comparative cephalometric analyses for adult Spanish and Japanese populations.

From the above perspectives, we conducted this study to assess differences in facial and dental morphological characteristics between adult Spanish and Japanese women with Class I malocclusion using lateral cephalograms.

Materials and Methods

Subjects

The lateral cephalograms of 33 adult Spanish women and 33 adult Japanese women with Class I malocclusion were randomly selected from the Orthodontics Master, University of Barcelona, Spain, and the Department of Orthodontics, Tokyo Medical and Dental University, Japan, respectively. All patients satisfied the following criteria: female sex; age, 18–35 years; skeletal Class I malocclusion (ANB angle, 2°–5°; angle Class I malocclusion; arch length discrepancy, –10 mm to +10 mm; overjet, 1–5 mm; overbite, 1–5 mm); absence of congenital anomalies, significant facial asymmetry, or congenitally missing teeth, with the exception of the third molars; absence of severe crowding; and absence of significant temporomandibular joint problems.^[17,18]

Cephalometric analyses

All lateral cephalograms were obtained with the teeth in maximum intercuspation using a cephalostat orientated in the Frankfort horizontal plane. All films were traced by the same investigator. In accordance with previous studies,^[17,18,21] 11 angular measurements were computed for skeletal hard tissue analyses (facial angle, angle of convexity, A–B plane, mandibular plane angle, Y-axis angle, FH–SN, SNA angle, SNB angle, ANB angle, gonial angle, and ramus plane angle to FH) [Figure 1] and 6 angular measurements were computed for dental hard tissue analyses [interincisal angle, L1 to mandibular plane, Frankfort-mandibular incisor angle (FMIA), U1 to FH, U1 to SN plane, and occlusal plane to FH] [Figure 2].

Reliability

Twenty randomly selected lateral cephalograms were digitized twice within an interval of a few weeks by the

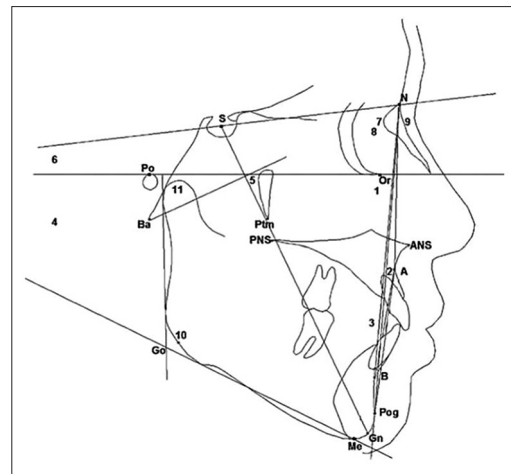


Figure 1: Skeletal cephalometric measurements: 1. facial angle; 2. convexity angle; 3. A–B plane; 4. mandibular plane angle; 5. Y-axis angle; 6. FH–SN; 7. SNA angle; 8. SNB angle; 9. ANB angle; 10. gonial angle; 11. ramus plane angle to FH

same investigator. Error differences in the identification of landmarks for the angular measurements were assessed by deriving the coefficient of reliability in accordance with previous studies.^[17,18,21,22]

Statistical analysis

All statistical analyses were performed using StatView version 5.0 (SAS Institute, Cary, NC, USA). Parameters were compared between the two groups using Mann–Whitney *U*-test. A *P* value <0.05, <0.01, or <0.001 was considered to be statistically significant.

Results

We found significant differences in 13 variables between the Spanish and Japanese women [Tables 1 and 2].

Skeletal variables

The angle between the Frankfort horizontal plane and SN plane was significantly larger in the Spanish than in the Japanese ($P < 0.001$). Furthermore, the Japanese exhibited a significantly ($P < 0.01$) smaller facial angle, which represented a less prominent chin. The “Ramus pl. to FH” angle and “Y-axis” were significantly larger in the Japanese than in the Spanish. This signifies that the mandible exhibited clockwise rotation in the Japanese. Even though we selected patients with skeletal Class I malocclusion with a fixed range for the ANB angle, there were significant ($P < 0.01$) differences in both the SNA and SNB angles. These differences indicated that the Japanese had significantly protruded upper and lower jaws relative to the cranial base. This finding was consistent with the significant ($P < 0.01$) difference in the “angle of convexity.”

Dentoalveolar variables

Compared with the Spanish, the Japanese exhibited protruded maxillary incisors, as indicated by the

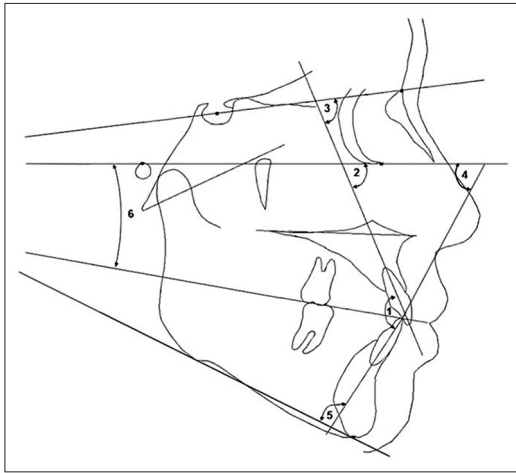


Figure 2: Dental cephalometric measurements: 1. interincisal angle; 2. U1 to FH; 3. U1 to SN plane; 4. the Frankfort-mandibular incisor angle; 5. L1 to mandibular plane; 6. occlusal plane to FH

significantly larger “U1 to FH” and “U1 to SN” angles ($P < 0.001$). With regard to the mandibular incisors, the “L1 to mandibular plane” angle was significantly larger ($P < 0.001$) in the Japanese than in the Spanish, while the FMIA was significantly larger ($P < 0.001$) in the Spanish than in the Japanese. These findings indicated that the mandibular incisors in the Japanese were protruded compared with those in the Spanish. As a result, the interincisal angle was significantly smaller ($P < 0.001$) in the Japanese than in the Spanish.

Discussion

In this study, we assessed differences in facial and dental morphological characteristics between adult Spanish and Japanese women with Class I malocclusion using lateral cephalograms. According to previous studies,^[21,23] a sample size of >21 subjects per group is theoretically necessary, and we selected 33 subjects each for the Spanish and Japanese groups in this study. Furthermore, because the mean ANB angle for Japanese patients with normal occlusion was reported to range from 2° to 5°, the Japanese patients in this study can be considered representative of the Japanese population with a normal skeletal relationship.^[17,18,21,24,25]

The skeletal analyses in this study showed that the Japanese exhibit more downward facial growth compared with the Spanish, as suggested by the facial angle values. This is consistent with the results of previous studies comparing the morphological characteristics of adult Japanese and Caucasian patients.^[6,21] Moreover, we found no difference in the gonial angle between the Japanese and Spanish women, whereas the former exhibited a larger “Ramus pl. to FH” angle than the latter. This indicated that the mandible in the Japanese was rotated clockwise compared with that in the Spanish.

Table 1: Comparison of skeletal variables between Spanish and Japanese adult women

Variables (degrees)	Spanish	Japanese	Significance
Facial angle	88.6±3.4	86.5±3.0	**
Angle of convexity	5.8±3.6	8.3±2.8	**
A-B plane	-6.6±1.9	-5.5±1.8	*
Mandibular plane	24.7±5.9	27.0±5.2	NS
Y-axis	59.8±3.8	63.2±3.4	***
FH-SN	11.2±2.3	8.0±3.1	***
SNA	80.2±3.4	82.6±3.4	**
SNB	76.5±3.6	78.6±3.0	**
ANB	3.7±1.1	4.0±1.0	NS
Gonial angle	122.7±7.1	120.5±6.0	NS
Ramus pl. to FH	82.0±4.9	86.5±5.0	***

Means and standard deviations are shown. NS – Not significant. * $P < 0.05$, ** $P < 0.01$, *** $P < 0.001$

Table 2: Comparison of dentoalveolar variables between Spanish and Japanese adult women

Variables (degrees)	Spanish	Japanese	Significance
Interincisal angle	133.0±9.2	117.7±10.1	***
L1 to mandibular plane	91.2±7.2	97.8±6.5	***
FMIA	64.0±7.7	55.2±6.0	***
U1 to FH	111.0±5.5	117.5±6.7	***
U1 to SN	99.8±6.5	109.5±6.8	***
Occlusal pl. to FH	7.1±3.7	8.8±4.0	NS

Means and standard deviations are shown. NS – Not significant. *** $P < 0.001$

With regard to dental relationship, the maxillary and mandibular incisors showed significant labial tipping in the Japanese compared with those in the Spanish. As a result of this protrusion, the interincisal angle was significantly smaller in the Japanese than in the Spanish.

In the field of orthodontics, the ideal FMIA is 65° for adult Caucasian patients, and it has been shown that the FMIA for the Japanese is 57°, which is smaller than that for Caucasians.^[25,26] Therefore, the standard FMIA for the Caucasian population should not be applied to other ethnic groups. For instance, the average FMIA for adult Egyptian and Saudi women is 59° and 54°, respectively.^[17,18,27] With regard to the Frankfort-mandibular plane angle (FMA), Japanese women showed significantly larger values when compared with Egyptian women, but not when compared with Saudi women.^[17,18] According to previous studies,^[6,21] the FMA angle is smaller for Caucasian women than for Japanese women; however, we found no significant differences between Japanese and Spanish women [Table 1].

The presence of differences in the need and demand for orthodontic treatment among ethnicities is an interesting topic. For instance, the motivation to seek orthodontic treatment differs between ethnic groups in the United States.^[28] Among Asians, Koreans tend to seek orthodontic treatment for Class I and Class II

malocclusions and deep bite more frequently than the Japanese, while they seek treatment for Class III malocclusion and open bite less frequently than the Japanese.^[29] These findings suggest the importance of awareness regarding differences in the perception of malocclusion between different ethnic groups, even if they belong to neighboring countries.

Conclusion

We determined differences in the dental and facial morphology between adult Spanish and Japanese women with Class I malocclusion in this study. Such morphological differences should be considered at the time of orthodontic treatment planning for patients from various ethnic groups to achieve satisfactory treatment outcomes and retention. Further studies on the dental and facial morphological differences among other ethnic groups will increase the knowledge base for this topic and lead to advances in the field of orthodontics in the future.

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Conflicts of interest

There are no conflicts of interest.

References

- Farkas LG. Anthropometry of the Head and Face in Medicine. New York: Elsevier; 1981.
- Farkas LG, Katic MJ, Forrest CR, Alt KW, Bagic I, Baltadjiev G, *et al.* International anthropometric study of facial morphology in various ethnic groups/races. *J Craniofac Surg* 2005;16:615-46.
- Hwang HS, Kim WS, McNamara JA Jr. Ethnic differences in the soft tissue profile of Korean and European-American adults with normal occlusions and well-balanced faces. *Angle Orthod* 2002;72:72-80.
- Cerci V, Martins JE, de Oliveira MA. Cephalometric standards for white Brazilians. *Int J Adult Orthodon Orthognath Surg* 1993;8:287-92.
- Alcalde RE, Jinno T, Orsini MG, Sasaki A, Sugiyama RM, Matsumura T, *et al.* Soft tissue cephalometric norms in Japanese adults. *Am J Orthod Dentofacial Orthop* 2000;118:84-9.
- Miyajima K, McNamara JA Jr., Kimura T, Murata S, Iizuka T. Craniofacial structure of Japanese and European-American adults with normal occlusions and well-balanced faces. *Am J Orthod Dentofacial Orthop* 1996;110:431-8.
- Alcalde RE, Jinno T, Pogrel MA, Matsumura T. Cephalometric norms in Japanese adults. *J Oral Maxillofac Surg* 1998;56:129-34.
- Shalhoub SY, Sarhan OA, Shaikh HS. Adult cephalometric norms for Saudi Arabians with a comparison of values for Saudi and North American Caucasians. *Br J Orthod* 1987;14:273-9.
- Bishara SE, Abdalla EM, Hoppens BJ. Cephalometric comparisons of dentofacial parameters between Egyptian and North American adolescents. *Am J Orthod Dentofacial Orthop* 1990;97:413-21.
- Cotton WN, Takano WS, Wong WM. The downs analysis applied to three other ethnic groups. *Angle Orthod* 1951;21:213-20.
- Richardson ER. Racial differences in dimensional traits of the human face. *Angle Orthod* 1980;50:301-11.
- Bacon W, Girardin P, Turlot JC. A comparison of cephalometric norms for the African Bantu and a Caucasoid population. *Eur J Orthod* 1983;5:233-40.
- Uesato G, Kinoshita Z, Kawamoto T, Koyama I, Nakanishi Y. Steiner cephalometric norms for Japanese and Japanese-Americans. *Am J Orthod* 1978;73:321-7.
- Nanda R, Nanda RS. Cephalometric study of the dentofacial complex of north Indians. *Angle Orthod* 1969;39:22-8.
- Swlerenga D, Oesterle LJ, Messersmith ML. Cephalometric values for adult Mexican-Americans. *Am J Orthod Dentofacial Orthop* 1994;106:146-55.
- Evanko AM, Freeman K, Cisneros GJ. Mesh diagram analysis: Developing a norm for Puerto Rican Americans. *Angle Orthod* 1997;67:381-8.
- Abbassy MA, Horiuchi M, ElHarouny N, Kanno Z, Ono T. Comparative cephalometric study of class I malocclusion in Egyptian and Japanese adult females. *Orthod Waves* 2012;71:59-65.
- Abbassy MA, Abushal A. Differences in dentofacial characteristics of class I malocclusion between Saudi and Japanese adult females. *J Orthod Sci* 2015;4:86-91.
- Yamauchi K, Sakuda M. Relationship between dental arch and craniofacial components: Japanese male adults with normal occlusions. *J Japan Orthod Soc* 1959;18:2124.
- Engel G, Spolter BM. Cephalometric and visual norms for a Japanese population. *Am J Orthod* 1981;80:48-60.
- Ioi H, Nakata S, Nakasima A, Counts AL. Comparison of cephalometric norms between Japanese and Caucasian adults in antero-posterior and vertical dimension. *Eur J Orthod* 2007;29:493-9.
- Bukhary MT. Comparative cephalometric study of class III malocclusion in Saudi and Japanese adult females. *J Oral Sci* 2005;47:83-90.
- Hulley SB, Cummings SR, Browner WS, Grady DG, Newman TB. *Designing Clinical Research*. Philadelphia: Lippincott Williams and Wilkins; 2001.
- Miura F, Inoue N, Suzuki K. Cephalometric standards for Japanese according to the Steiner analysis. *Am J Orthod* 1965;51:288-95.
- Iwasawa T, Moro T, Nakamura K. Tweed triangle and soft-tissue consideration of Japanese with normal occlusion and good facial profile. *Am J Orthod* 1977;72:119-27.
- Tweed CH. The Frankfort-Mandibular Incisor Angle (FMIA) in orthodontic diagnosis, treatment planning and prognosis. *Angle Orthod* 1954;24:121-69.
- Hashim HA, Balkhi KA. Soft tissue relation and tweed triangle in a Saudi sample. *Pak Oral Dent J* 2002;22:127-32.
- Davis BB, Bayirli B, Ramsay DS, Turpin DL, Paige A, Riedy CA, *et al.* "Why do you want your child to have braces?" investigating the motivations of hispanic/Latino and white parents. *Am J Orthod Dentofacial Orthop* 2015;148:771-81.
- Chung CJ, Hwang CJ, Soma K. Differences in the perception of needs and demands for orthodontic treatment between Koreans and Japanese. *Orthod Waves* 2007;66:9-14.