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Original Article

Anthropometric Facial Characteristics of Adult *Tae-eumin* of Northern and Southern Lineage in the Korean Peninsula

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Objectives: This study aimed to examine the difference of external appearance measurements in subjects of different regional lineages as subgroups within the *Tae-eumin Sasang* grouping.
Methods: We chose 51 *Tae-eumin* subjects diagnosed by Korean *Sasang* constitutional medical doctors aided by voice analysis. The subjects were divided into two groups, the northern and southern lineages, by an expert on facial characteristics of the two lineages.
We took pictures of their frontal and lateral views by Martin's method, measured projected length of face with the Facial Feature Measurement Program, and analyzed anthropometric facial differences between the northern and southern types.
Results: Results show differences between the northern and southern types. First, the northern type of face has bigger measurements than the southern type on the frontal face. Second, the northern type of face has higher measurements of "height", which means distance from pupil to a specific measurement point, than the southern type on the frontal face. Third, on the frontal face, the northern and southern types have differences with respect to eyebrow, point of sellion, and eye. Fourth, on the side face, the northern and southern types have differences in lip, mandible and ear.
Conclusions: We found our anthropometric facial measurements of the northern and southern lineages to be in accordance with previous literature. Knowledge of the differences between the northern and southern lineages can be a hint in constitutional diagnosis when differentiation is clinically confusing.

Key Words : *Sasang* constitutional medicine, facial appearance of Tae-eumin

Introduction

Classification by 4-type constitution is a major characteristic that separates *Sasang* constitutional medicine from conventional Korean medicine. Lee[1] has written in his work that Lee Jema pointed out physical characteristics and posture, appearance and manner of speaking, temper and disposition, basic mindset, conditions for maintaining health, and diseases specific to each constitution as key to a constitutional diagnosis. Observation of appearance is still important in clinical diagnosis as of today. Lee[2] has analysed the relative importance that is clinically given to observation of facial features, voice, skin and pulse by Korean medical doctors in constitutional differentiation, and more than half of all doctors included in the study emphasized facial observation by placing over 40% importance on it.

Cho[3,4] has illustrated the characteristic features of the northern and southern facial appearance in two books. These books illuminate the relationship between Korean facial features and migration, which has led

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to different facial feature lineages within the Korean people. This research was made based on the knowledge that native Thais and Thais of Chinese lineage have distinct differences in facial features, and that such categorization may also be possible among Koreans. The major features that distinguish the northern and southern lineages are described in Table 1.

Jung[5] *et al*. made anthropometric measurements according to Martin's method[5,11,12], and reported differences in creases and forehead length by age and by northern or southern lineage. The differences of each lineage were compared at the forehead, double eyelid, nose, mouth, and skin.

The works of *Sasang* constitutional medicine are based on pre-developed anthropometric methods, and are evolving from two-dimensional research to three-dimensional work. Three-dimensional facial anthropometric research is still in its primary stage [6-8].

Former works on *Sasang* constitution and facial features have put emphasis on the relationship between constitution and facial features, but did not take lineage into consideration. But since lineage can also cause differences in facial shape and features, analysis of the differences between lineages is necessary[9].

In this study, we aimed to compare differences between the northern and southern lineages within each constitution by two-dimensional research, and assess the relationship between constitution and lineage. By discovering which measurements vary within a constitution by lineage, we hope to prevent mistaking lineage differences for constitutional ones.

Methods

This research was done on outpatients at the East-West Health Promotion Center and *Sasang* Constitutional Health Clinic at the East-West Neo Medical Center, Kyunghee University. Patients with appropriate picture data and affirmed constitution and

Table 1. Differences Between the Southern and Northern lineages

	Southern lineage (1st-3rd)	Northern lineage (Tungus lineage, Altai lineage)
Facial outline	Squared or triangular	Oval or yam-shaped
Prominence of facial features	Marked prominence	Flat
Forehead	Wide and short	Tall
Eyebrows	Long and clear	Short and unclear
Glabella	Narrow	Wide
Eyes	Big and wide	Small and narrow
Double eyebrows	Present (Absent in some cases)	Absent
Distance between pupils	Wide	Narrow
Nose length	Short	Long
Nose width	Wide	Narrow
Tip of nose	Rounded	Pointed
Sidewalls of nose	Big and clear	Small and unclear
Philtrum	Deep, narrow and clear	Shallow and unclear
Lip thickness	Thick	Thin
Earlobe	Large	Small
Hair	Thick straight hair or curly hair	Thin straight hair
White hair	Many	Few

lineage were included in this study. Anthropometric data using an anthropometric program was analysed by MATLAB version 6.5. SPSS 13.0 was used to analyse means and standard deviations of lineages within each constitution.

1. Subjects

1) Inclusion criteria

Patients who were given constitutional diagnosis were included as subjects. The constitutional diagnosis was first screened by voice analysis, and confirmed by experienced practitioners according to the criteria based on the classical literature such as physical characteristics and posture, appearance and manner of speaking, temper and disposition, diseases specific to each constitution, and basic mindset.

(1) Male outpatients of the *Tae-eumin* in their forties were included. Han[10] has reported that people past their mid-fifties showed distinct loss of skin tone and more wrinkles due to changes in elastic fibers in the skin tissue.

(2) Outpatients at the East-West Health Promotion Center and *Sasang* Constitutional Health Clinic at the East-West Neo Medical Center, Kyunghee University, who visited from September to November of 2008

(3) The northern and southern lineage was evaluated as according to Cho's methods, where the 1st and 3rd southern types were grouped as northern lineage, and the 'Tungus' and 'Altai' types were grouped as southern. The evaluation and classification was performed by Cho Yong-jin, who had a written method of classification about northern type and southern type in his books[3,4]

(4) Patients with pictures of the frontal and lateral views were included.

2) exclusion criteria

(1) Patients who had undergone previous facial surgery.

(2) Patients with disfiguration of the face including wounds, facial palsy, or tattoos.

(3) Other patients evaluated by the examiner as being mentally or physically unfit to be included in the study.

2. Method of Photography

1) Photography settings

(1) Camera

A Nikon D300 body and a Nikon 50mm F1.8D lens were used. Shutter speed was set to 1/30 seconds and the iris was on automatic.

(2) Illumination

The pictures were taken in and indoor environment with normal fluorescent lighting set as brightly as possible.

(3) Views and subject posture

The anthropometric measurement methods described by Cho Yong-jin were used.

① Subject posture

The pictures were taken in a standing position. Subjects were asked to look straight forward. Glasses, earrings, and necklaces were removed before photography. The hairline at the frontal view and ears at the lateral view were clearly exposed. The measuring stick was placed 1 cm below the chin tip horizontally in the frontal view. Midline of frontal face and foreside of ruler have to make a straight line. The distance from the lens to the pupils was 120cm.

② Frontal view

The camera lens was set at subject eye level. The distance from lens to pupil was fixed at 120cm, and the camera body was fixated in a vertical position. The clarity was focused as to be clearly able to define pupil outline, and the viewfinder was aimed at the center point between both pupils

③ Lateral view

The picture was taken at the left side of the face. The viewfinder was centered at the

tragus, and the eyes were placed so as to have the left cornea overlap the right cornea. The clarity was focused as to clearly define the vertical nose line. An imaginary line drawn from the otobasion superius to the upper 1/3 point of pupil height was placed to be parallel to horizontal.

2) Facial anthropometric measurements: MATLAB 6.5 was used for analysis

Measurement points were marked on the frontal and lateral pictures taken according to the above criteria and data was gathered. The anthropometric program required Windows 98 and MATLAB 6.5 support. MATLAB is a programming language used for mathematical and engineering calculations, based on matrix calculations. It integrates mathematical and statistical analysis, matrix calculation, signal assessment, and easy-to-use graphic functions to provide high-spec calculation and visualization of data. The MATLAB coding system is composed of mathematical symbols and basic C language, and is widely used in mathematical calculations, algorithm development, situation modeling and analysis, and graphic expression in scientific and engineering fields

3) Measurement points

A total of 157 measurement points including 97 frontal points and 60 lateral ones were used. The measurement points were made according to the definitions of each point as explained in Yun *et al*.[6-8]. and the points which were perceived by the observer as to best fit these characteristics were chosen. Points which were unmarkable on more than half of the pictures were excluded from analysis. In the frontal view, the 2nd and 3rd crease point were each markable in 18 cases.

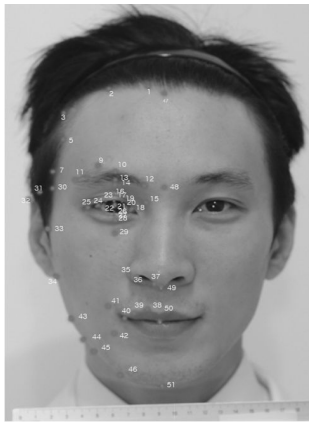

Fig. 1. Measurements on frontal face

3. Rt. upper corner point 5. Rt. middle corner point 7. Rt. lower corner point
9. Top point on Rt. Eyebrow 10. Upper margin on Rt. eyebrow 11. Distal point on Rt. eyebrow 12. Proximal point on Rt. eyebrow 13. Lower margin on Rt. eyebrow
14. Sulcus point of Rt. upper eyelid 15. Rt. point of sellion region 17. Rt. upper eyelid point
19. Proximal arc point of Rt. upper eyelid arc 20. Medial point of Rt. iris 21. Rt. pupil
26. Rt. lower eyelid point. 41. Rt. naso-labial sulcus point 45. Rt. lat. point of chin
47. Trichion 48. Glabella 49. Subnasale 50. Stomion 51. Gnathion

Fig. 2. Measurements on frontal face

0. Vertex 6. Trichion 7. Metopion 8. Concave point of forehead 9. Ophryon 10. Glabella
11. Nasion 12. Sellion 13. Dorsal point of nose 24. Mid-point of sup. labial margin
25. Stomion 26. Cheilion 29. Mid-point of inf. labial margin 31. Prominent point of mentus
32. Mandibular tubercle 33. Gnathion 55. Lat. point of lt. auricle 56. Polion 57. Tragion
58. Anti-tragion 64. Inf. point of nuchal hairline

4) Measurements

Measurements were made as according to the definitions of each point as explained in Yun *et al*.[6-8] 46 points were marked bilaterally in the frontal view. Each point provides 7 measurements including right and left height, breadth, and glabella-projected, thus providing 322 measurements and 5 facial midline heights. An additional 302 measurements can be gained from formulas involving the measurements, totaling 629 measurements in all. 60 points were marked in the lateral view. Each point provides 2 measurements, the height and Polion-projected. Therefore, 120 measurements were obtained, and an additional 130 were calculated by using formulas, totaling 250 (Fig. 1, 2).

3. Statistical analysis

The means and standard deviation of northern and southern lineage subjects of the *Tae-eumin* was analysed using an independent T-test.

Results

1. Characteristics of Patients

1) Distribution of all visitors

From September to November 2008, 639 patients took pictures of their frontal and side face. Characteristics of patients are shown in Tables 2 and 3.

2) Of all 639, 40s age males with completed classification of type of face by Cho was 87. Their

Table 2. Characteristics of All Visitors

Distribution of Gender of all visitors		
Gender	Frequency	Percent (%)
Male	356	55.7
Female	283	44.3
Total	639	100.0
Distribution of Constitution of all visitors		
Constitution	Frequency	Percent (%)
Soyangin	115	18.0
Tae-eumin	295	46.2
Soeumin	229	35.8
Total	639	100.0

Table 3. Characteristics of All Visitors

Age	Frequency	Percent (%)
0-9 years old	6	0.9
10-19	3	0.5
20-29	44	6.9
30-39	171	26.8
40-49	262	41.0
50-59	118	18.5
60-69	26	4.1
70-79	8	1.3
80-	1	0.2
Total	639	100.0

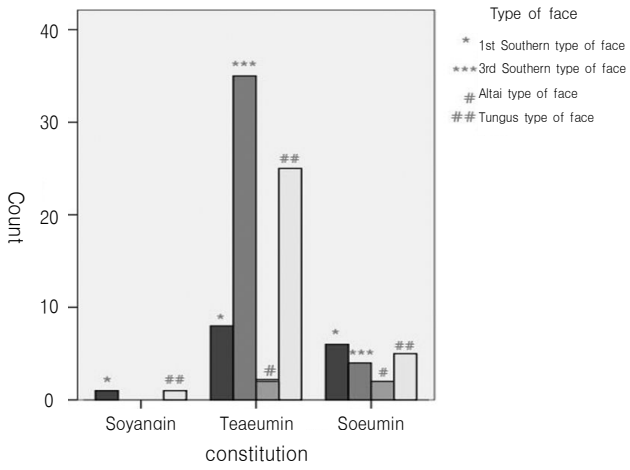

Fig. 3. Distribution of constitution and face type, age 40s adult male

distribution of constitution and type of face are shown in Fig. 3.

3) From all *Tae-eumin* with diagnosis of *Sasang* constitutional medicine and classification of type of face, 27 southern type and 24 northern type were selected. Reference points on frontal face are both pupil for height and glabella for glabella-projected.

Table 4. Measurements on Frontal Face 1. (References are to Fig. 4, 5)

Measurement	Type	N	Mean (cm)	S.D.	S-N (cm)	P-value	Mean of Result
1) Breadth‡ of top point on both eyebrows	S*	27	9.086	0.466	0.32	0.020	S>N (3.2mm)
	N†	24	8.762	0.492			
2) Upper margin on lt. eyebrow height	S	27	2.563	0.230	-0.19	0.034	N>S (1.9mm)
	N	24	2.750	0.356			
3) Distal point of lt. eyebrow height	S	27	1.584	0.297	-0.28	0.070	N>S (1.9mm)
	N	24	1.863	0.345			
4) Proximal point of rt. eyebrow height	S	27	1.627	0.212	-0.21	0.010	N>S (2.1mm)
	N	24	1.840	0.333			
5) Lower margin on rt. Eyebrow height	S	27	1.639	0.211	-0.21	0.004	N>S (2.1mm)
	N	24	1.848	0.276			
6) Lower margin on lt. eyebrow height	S	27	1.609	0.186	-0.31	0.000	N>S (3.1mm)
	N	24	1.917	0.289			
Sulcus point of rt. upper eyelid height	S	27	1.370	0.292	-0.2	0.01	N>S (2mm)
	N	24	1.566	0.22			
Sulcus point of lt. upper eyelid height	S	27	1.357	0.287	-0.28	0.001	N>S (2.8mm)
	N	24	1.637	0.249			
Breadth of both points of sellion region	S	27	2.021	0.351	-0.21	0.026	N>S (2.1mm)
	N	24	2.236	0.312			

* Southern type, † Northern type , ‡ distance between lt. & rt. point

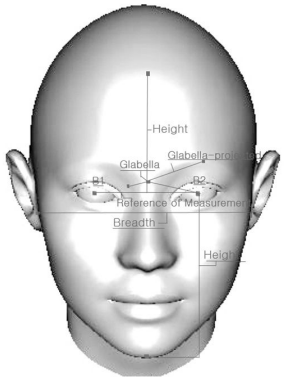

Fig. 4. Reference points on frontal face
Both pupils are reference points on measurement of 'Height'.
Height means distance from pupil to a specific measurement point
Glabella is reference point on measurement of 'Glabella projected'.
Glabella projected means distance from glabella to a specific measurement point

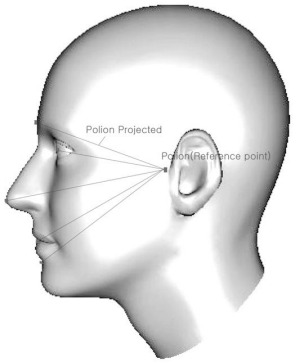

Fig. 5. Reference points on side face
Polion is reference point on measurement of 'Polion projected'.
Polion projected means distance from polion to a specific measurement point

Height means distance from pupil to a specific measurement point. G-projected means distance from glabella to a specific measurement point.

2. Differences of Measurement on Side Face

Differences according to type of face are shown on eyebrow, point of sellion, and eye. The northern type had much bigger measurements than the southern

Table 5. Measurements on Frontal Face 2. . (References are to Fig. 4, 5)

Measurement	Type	N	Mean (cm)	S.D.	S-N (cm)	P-value	Mean of Result
Breadth‡ of top point on both eyebrows	S*	27	1.375	0.063	1.03	0.025	S=N*1.03
	N†	24	1.331	0.071			
Proximal point of rt. eyebrow Height breadth ratio	S	27	0.247	0.034	0.89	0.006	S=N*0.89
	N	24	0.279	0.046			
Proximal point of lt. eyebrow Height breadth ratio§	S	27	0.247	0.035	0.88	0.006	S=N*0.88
	N	24	0.281	0.049			
Lower margin on rt. eyebrow Height breadth ratio	S	27	0.248	0.033	0.89	0.002	S=N*0.89
	N	24	0.28	0.038			
Lower margine on Lt. eyebrow Height breadth ratio	S	27	0.244	0.03	0.84	0.000	S=N*0.84
	N	24	0.291	0.039			
Sulcus point of Rt. upper eyelid Height breadth ratio	S	27	0.207	0.043	0.87	0.006	S=N*0.87
	N	24	0.238	0.033			
Sulcus point of Lt. upper eyelid Height breadth ratio	S	27	0.205	0.043	0.82	0.000	S=N*0.82
	N	24	0.249	0.038			

*Southern type, †Northern type, ‡(Breadth between rt and lt. point / distance between B1and B2 (Reference measurements of Breadth ratio are on Fig. 4.)
§ Height/ distance between B1and B2 (Reference measurement of Breadth height ratio (Fig. 4).

type on frontal face. (Table 4). Measurements of ratio also bigger on the northern type of face (Tables 5, 6).

1) Breadth ratio of top point of both eyebrows was wider on the southern type than the northern type.

Height breadth ratio was higher on the northern type. Specially, the distance from pupil to top point of both eyebrows indicates that distance from pupil to eyebrow is farther from a northern face than a southern face.

2) Breadth ratio of both points of the sellion region is wider on the northern type.

3. Differences of Measurement, Side Face.

The reference point of the side face is the polion. Polion-projected measurement is mostly bigger on southern type of face than northern type (Table 7).

1) Measurement points of lip were bigger on the southern type than the northern.

2) Prominent point of mentus polion-projected and mandibular tubercle polion-projected was bigger on the southern type than the northern.

3) Lateral point of the left auricle. Polion-projected was bigger on the northern type than the southern. This means ears of the northern type are close to the temporal bone of the brain.

As a result, first, the northern type has significant measurement value on the frontal face, while the southern type has significant measurement value on the side face. Second, on the northern type of face, measurement value relating to height is generally higher than the southern type, while on the Southern type of face, measurement value related breadth is generally wider than northern type. Third, if you want to know about differences between northern

Table 6. Measurements on Frontal Face 3 (References are to Fig. 4, 5)

Measurement	Type	N	Mean (cm)	S.D.	S-N (cm)	P-value	Mean of Result
Lt. point of sellion lesion Height to breadth ratio§	S*	27	0.071	0.038	0.70	0.005	S=N*0.70
	N†	24	0.102	0.035			
Breadth ratio‡: of both points of sellion region	S	27	0.306	0.053	0.90	0.021	S=N*0.90
	N	24	0.34	0.047			
Rt. lower eyelid point Height to breadth ratio§	S	27	0.075	0.013	1.14	0.012	S=N*1.14
	N	24	0.066	0.012			
Lt. lower eyelid point Height to breadth ratio	S	27	0.074	0.015	1.14	0.03	S=N*1.14
	N	24	0.065	0.015			
Lt. naso-labial sulcus point Height breadth ratio	S	27	0.564	0.516	0.56	0.000	S=N*1.14
	N	17	1.014	0.06			
Breadth ratio of both naso-labial sulcus points	S	27	0.596	0.547	0.55	0.000	S=N*0.55
	N	17	1.086	0.064			
Rt. lat. point of chin Height - breadth ratio	S	27	1.136	0.623	0.76	0.007	S=N*0.76
	N	22	1.494	0.111			
Lt. lat. point of chin Height - breadth ratio	S	27	1.141	0.628	0.76	0.007	S=N*0.76
	N	22	1.496	0.11			
Breadth ratio of both lat. point of chin	S	27	1.26	0.705	0.77	0.011	S=N*0.77
	N	22	1.632	0.099			

*Southern type of face, † Northern type of face, ‡:(Breadth between rt. and lt. point / distance between B1and B2 (Reference measurements of Breadth ratio on Fig. 4).

§Height/ Breadth ratio = Height/ distance between B1and B2 (Reference measurement of Breadth height ratio are on Fig. 4.)

Table 7. Measurements on Side Face (References are to Fig. 4, 5)

Measurement	Type	N	Mean (cm)	S.D.	S-N (cm)	P-value	Mean of Result
Mid-Point of sup. labial margin Polion-projected	S*	27	11.676	0.668	0.34	0.043	S>N (3.4mm)
	N†	24	11.339	0.479			
Cheilion Polion-projected	S	27	11.359	0.661	0.43	0.010	S>N (4.3mm)
	N	24	10.927	0.48			
Mid-point of inf. labial margin Polion-projected	S	27	11.961	0.706	0.36	0.035	S>N (3.6mm)
	N	24	11.597	0.474			
Prominent point of mentus Polion-projected	S	27	13.619	0.771	0.52	0.01	S>N (5.2mm)
	N	24	13.097	0.629			
Mandibular tubercle Polion-projected	S	27	14.022	0.806	0.43	0.044	S>N (4.3mm)
	N	24	13.59	0.685			
Lat. point of lt. auricle. Polion-projected	S	26	3.509	0.389	0.24	0.032	N>S (2.4mm)
	N	24	3.75	0.382			

* Southern type of face, †Northern type of face

and southern type of face, you have to observe measurement points of eyebrow, sellion region, eye on frontal face, and measurement points of ear, mandible, and lip on the side of the face.

Discussion

According to previous research, the three-dimensional recognizer is very accurate in its hardware aspect, but the software use has seen some errors. The markings at the nose and chin are especially unstable. Although three-dimensional research is being undertaken, we judged the results to be inadequate for clinical use and thus carried on this research in a two-dimensional form[11,12].

On the Korean peninsula, differentiation between the northern and southern lineages has been used frequently in research on differences in culture between the two lineages. According to Cho[8], constitutionally speaking, the southern lineage migrated from the islands which include Indonesia and Malaysia, and moved along the southwestern seas and rivers of the Korean peninsula 12,000 to 8,000 years ago. The northern lineage consists of Siberian people who withstood the Ice age 25,000 years ago for 15,000 years and migrated to the peninsula, and spread mainly along the inland areas.

Their most striking difference is that people of the southern lineage have a squared face, clear pronunciations and depressions of facial features, dark eyebrows and big eyes with double eyebrows. They have short noses with prominent nose tips. In contrast, the northern lineage shows flat faces with small eyes, noses, and noses with fuzzy eyelashes and eyebrows and small earlobes. When the head is divided into three sections, the forehead and cranial cap is relatively high, creating a yam-shaped head. The northern lineage has a forehead that slopes backward, and the southern lineage has a protruding forehead. Our measurements have confirmed these findings in the ears, eyebrows, eyes, and forehead.

Some characteristics have been shown in previous two-dimensional work. Intra-constitutional differences have been mistaken for inter-constitutional differences on occasion. This research aims to clarify the difference between facial measurements of intra-constitutional subgroups and therefore enhance precision in constitutional diagnosis

From this research, we found differences of measurement points between Southern and Northern face

types, so we have to discriminate using these differences among constitutions.

Additional, individual differences which the naked eye can catch are not only in one dimension, but also 2 dimensions, like squares. So, we can expect to find significant differences of squares delineating the boundary of the face. For example, sellion lesion height and proximal point of eyebrow height is bigger on a Northern face. We can calculate a square or quadrangle which has 4 apexes, proximal points of both eyebrows and the point of both sellion regions. In this way, we expect to calculate a further boundary about the face.

Conclusion

This research was to find different features between Northern type and Southern type of face as intra-constitutional subgroups. From this, we aimed to find significant measurement points which have intra-constitutional significant differences. Finally, we aimed to differentiate measurement points which have significant intra-constitutional differences and inter-constitutional differences.

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