〔Original〕 Matsumoto Shigaku 29 : 288～293, 2003

key words : cephalometrics — skeletal Class III — adult female — sagittal osteotomy

Difference in treatment outcome of British and Japanese surgical class III patients associated with mandibular setback

KOYO NAKAMURA[1], NORIO NAGATA[2], YOSHIRO IIDA[3], KAYO IIDA[4], TORU KAGEYAMA[5] and NOBUYUKI ISHII[6]

[1]*Ina City, Nagano*

[2]*Naha City, Okinawa*

[3]*Division of Hard Tissue Research, Graduate School, Matsumoto Dental University (MDU)*

[4]*Department of Hard Tissue Research, Graduate School, MDU*

[5]*Division of Hard Tissue Research, Graduate School, MUD*

[6]*A Faculty of Pediatric Dentistry, Hyogo Pref. Children's Hospital*

Summary

The purpose of this clinical research was to examine the racial differences in skeletal morphology of skeletal Class III abnormalities and in the ortho-surgical treatment outcome of Class III malocclusion associated with mandibular setback sagittal osteotomy between Japanese and British Caucasian female adult Class III patients. The sample consisted of 35 Class III Japanese female surgical subjects in MDU Hospital and 30 Class III British subjects (23 female and 7 male). The operative procedure was solely a backward sliding sagittal split osteotomy with a wire fixation. True skeletal open bite cases associated with high mandibular plane angle were excluded.

The original skeletal differences in Japanese and British Caucasian Class III subjects showed a significant difference in the length of the anterior cranial base (S-N) ($p<0.001$). The Japanese Class III subjects showed a significant difference in the parameters of U 1-UR and L 1-LR to palatal plane and Go-Me to palatal plane ($p<0.001$), and in the axis of maxillary incisor to S-N ($p<0.01$) and S-N-L 1 ($p<0.05$). At post-retention (1 year after op.), Go-Me to ANS-PNS and the length of Go to the palatal plane and Ar-Go (ramus height) related to the vertical position of point Go showed a larger difference (from $p<0.05$, 0.01 to 0.001). The Japanese surgical cases showed a more vertical problem with the increased mandibular plane angle compared to the British Caucasians.

Introduction

The characteristics of adult skeletal Class III malocclusion are a shorter anterior cranial base (S-N length) a retrusive maxilla, proclined maxillary incisors, retroclined mandibular incisors, a pro-

(submitted November 4, 2003 ; accepted December 24, 2003)

trusive mandible and longer lower facial height, when compared with those of skeletal class I [1-6]. Although the etiology and the dento-craniofacial components of malocclusions among ethnic groups are quite different, Ngan[6] reported the differences in the skeletal and soft tissue structures of Chinese and Caucasian Class III surgical cases. The findings were that the Chinese group showed a shorter anterior cranial base, a larger articular angle, a smaller gonial angle, a more prognathic maxilla with a shorter length of the maxilla and prognathic mandible, and a larger length of the body of the mandible than those of the Caucasians. Furthermore, a more acute nasolabial angle in the Chinese sample (boys and girls) was observed, exclusively.

Although Japanese and Chinese may inherit a gene similar to that of Mongoloids, there has been no report studying the differences in morphology of adult skeletal Class III malocclusion in Japanese and British Caucasians. The difference in treatment outcome in both groups has been studied useing the parameters of skeletal and soft tissue cephalometric analysis because the differences in the morphology of the ethnic groups could adapt to different diagnosis and treatment planning.

The present Class III ortho-surgical study was focused on mandibular prognathism with a hyperdivergent pattern, which received mandibular setback surgery only. The skeletal and soft tissue changes before and after surgery were statistically analyzed in Japanese and British Caucasians.

Materials and Methods

Sample. The Japanese Class III subjects consisted of 35 female surgical patients in MDU Hospital. Although British data was studied by one of the co-authors (Prof. Hunt), the British Class III subjects consisted of 30 patients (23 female and 7 male) in EDI Hospital and the Oral Surgery Department of Guy's Hospital who met the following criteria : (1) young adult without more than one missing posterior tooth ; (2) the operative procedure was solely a backward sliding sagittal split osteotomy with a wire fixation ; (3) true skeletal open bite cases associated with a high mandibular plane angle were excluded. The Japanese cases were fixed using inter-maxillary heavy elastics with hooks soldered to .017 x .025 s.s. wire, and the number of elastics was decreased gradually. British cases were fixed using inter-maxillary wire to cast metal cap splints cemented to the teeth.

Fixation was for a minimum of six and a maximum of eight weeks in both groups.

Cephalometric analysis

In all patients, three sets of lateral head films were available and had been taken before treatment, a few months after operation and one year after operation. The parameters of cephalometric measurements were matched to those of Hunt's study (Figures 1, 2 ,3 and 4). Differences (Mean and S. D.) in the measurements between Japanese and Caucasian subjects were statistically analyzed.

Cephalometric landmarks and measurements

Linear measurements (Figure 2)

1. S-N : Linear distance between point S to point N.
2. N to ANS-PNS : Vertical distance from point N to palatal Pl.
3. S to ANS-PNS : Vertical distance from point S to palatal Pl.
4. Me to ANS-PNS : Vertical distance from point Me to palatal Pl.

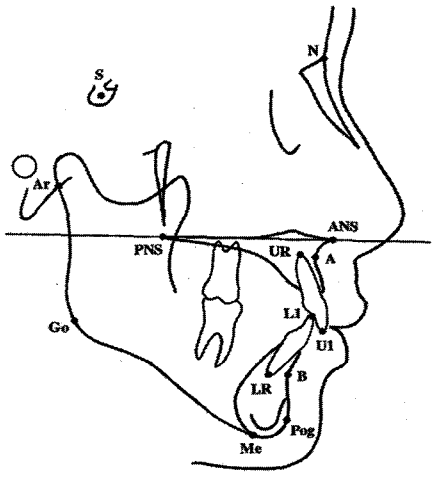

Fig.1 : Landmarks for cephalometric analysis.

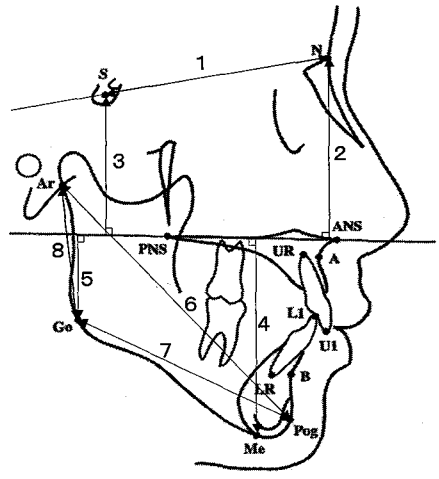

Fig.2 : Linear measurements.

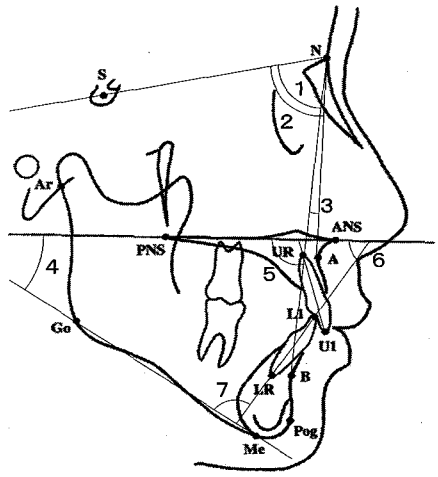

Fig.3 : Angular measurements.

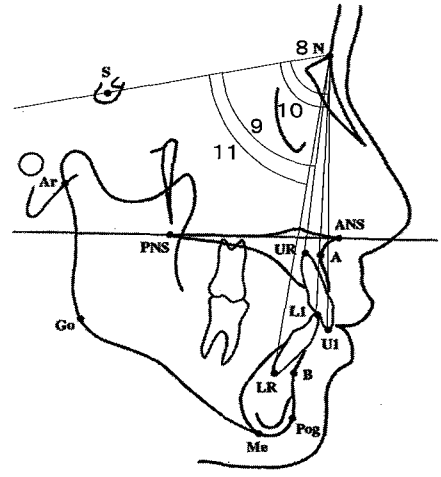

Fig.4 : Specific measurements used for Hunt's analysis.

5. Go to ANS–PNS : Vertical distance from point Go to palatal Pl.
6. Ar–Pog : Linear distance between point Ar to point Pog.
7. Go–Pog : Mandibular body length.
8. Ar–Go : Ramus height of mandible.

Angular measurements (Figures 3 and 4)

1. S–N–A : Angle of S–N and point A.
2. S–N–B : Angle of S–N and point B.
3. A–N–B : Angle of point A, point N and point B.
4. Go–Me/ANS–PNS : Mandibular plane angle of palatal plane to mandibular plane.
5. U 1–UR/ ANS–PNS : Axis of maxillary central incisor to palatal plane.
6. L 1–LR/ANS–PNS : Axis of mandibular central incisor to palatal plane.

7. L 1–LR/Go–Me : Axis of mandibular central incisor to mandibular plane.
8. S–N–U 1 : Angle of S–N to edge of maxillary central incisor.
9. S–N–UR : Angle of S–N to root apex of maxillary central incisor.
10. S–N–L 1 : Angle of S–N to edge of mandibular central incisor.
11. S–N–LR : Angle of S–N to root apex of mandibular central incisor.

Results

Dental and Skeletal analysis (Table 1).

Before treatment, the length of S–N (anterior cranial base) showed a significant difference between the two ethnic groups, exclusively. No other linear measurements showed a significant difference between the groups. The Japanese Class III subjects showed a significant difference in the parameters of U 1–UR to ANS–PNS (palatal plane), Ll–LR to ANS–PNS and L 1–LR to Go–Me (mandibular plane angle) at the level of $p<0.001$. Ethnic difference was observed significantly in the angular measurements of S–N–U 1, S–N–UR ($p<0.01$) and S–N–L 1 ($p<0.05$).

At post–operation, the parameters related to inclination of incisors remained significant by different but showed less difference ($p<0.01$ or 0.05). Significant difference was observed in Go–Me to ANS–PNS, Ar–Go ($p<0.01$) and the points Go and Me to ANS–PNS ($p<0.05$). ANB angle showed a significant difference ($p<0.05$). ANB was improved to 1.0 degree in the Japanese but was maintained at −0.8 degrees in the British Caucasians.

At post–treatment, Go–Me to ANS–PNS, Go to ANS–PNS and Ar–Go related to the vertical position of point Go showed a larger difference ($p<0.01$) in the mean of the parameters than those observed at post–operation ($p<0.05$ or 0.01). The measurements of the other parameters at post–treatment were similar to those observed at post–operation.

Table 1 : Cephalometric analysis of pretreatment, post–operation and post–treatment subjects in Japanese and British caucasians.

	Pretreatment					Post–operation					Post–treatment				
	Japanese mean	S.D.	Cauacian mean	S.D.	Significance	Japanese mean	S.D.	Cauacian mean	S.D.	Significance	Japanese mean	S.D.	Cauacian mean	S.D.	Significance
S–N	62.9	2.5	65.6	3.1	***	62.9	2.7	–	–	–	62.9	2.7	65.6	3.1	***
S–N–A	81.4	3.6	80.5	4	NS	81.6	3.6	80.4	3.9	NS	81.3	3.4	80.5	4	NS
N to ANS–PNS	51.3	2.6	50.7	3.6	NS	51.2	3	–	–	–	51.3	3	50.6	3.6	NS
S to ANS–PNS	40.7	3.2	40.3	3.7	NS	45.1	3.2	–	–	–	40.9	2.6	40.3	3.7	NS
S–N–B	85.1	4.2	85.1	3.7	NS	80.6	3.6	81.2	3.8	NS	80.9	3.7	81.6	3.8	NS
Go–Me/ANS–PNS	31.5	6.4	28.3	5.7	NS	35.5	8.2	28.9	6.6	**	35.7	6.9	28.7	5.6	***
Me to ANS–PNS	70.6	5.8	67.5	6.1	NS	70.1	5.3	66.9	6.1	*	69.6	5	67.1	5.8	NS
Go to ANS–PNS	32.6	4.3	31.7	4.7	NS	30.2	6.8	33.7	5.4	*	28.9	5.7	33.5	4.1	***
Ar–Pog	113.8	4.6	114.3	7.7	NS	107.9	4.3	109.5	6.9	NS	108.4	4.5	109.8	6.5	NS
Go–Pog	77.4	4.6	78.3	4.9	NS	73.6	5.8	71.8	4.6	NS	74.6	5.5	72.5	4.3	NS
Ar–Go	46.5	4.2	46.6	5.3	NS	43.4	7.1	48.6	5.5	**	42.5	6.4	48.4	5	***
A–N–B	−3.6	2.6	−4.6	2.8	NS	1	3.1	−0.8	2.4	*	0.4	2.7	−1.1	2.5	*
U 1–UR/ANS–PNS	121.2	7	114.3	6.7	***	118.7	6.7	113.6	6.4	**	120.5	7.5	114.2	6.6	**
U 1–LR/ANS–PNS	66.3	8.5	78.1	9.1	***	67	8.5	77.9	10.4	***	67.9	7	77.3	9.4	***
L 1–LR/Go–Me	82.2	6.8	73.6	8.7	***	77.5	6	73.2	9.5	*	76.4	5.4	74	8.3	NS
S–N–U 1	87.2	3.7	84.3	4.1	**	87	3.8	84.3	4	*	87.2	3.9	84.3	3.9	**
S–N–UR	78.6	2.9	76.2	3.7	**	79.3	3.6	76.4	3.6	**	78.8	3.6	76.4	3.7	*
S–N–L 1	89.8	4.5	86.9	3.7	*	84.6	3.8	82.3	3.8	*	85.1	3.9	82.9	3.9	*
S–N–LR	83.9	4.2	83	3.8	NS	79.6	3.5	79.3	3.8	NS	80.1	3.7	79.8	3.7	NS

The symbols mean the significant level : p = <0.05 (*), p = <0.01 (**) and p = <0.001 (***).

Discussion

Two-jaw surgery for severe skeletal Class III malocclusion in America is much more popular than the surgical procedure based on one-jaw surgery for mandibular setback in Japan [8,9].

The Japanese skeletal Class III sample showed a significantly shorter S-N length and larger mandibular plane angle than those of the British Caucasians[7] (Figure 5). Ngan et al.[6] reported that Chinese skeletal Class III subjects exhibited a shorter cranial base and a more prognathic maxilla and mandible than those of American Caucasians. Although these was no significant difference in SNA and SNB angles between the two ethnic groups, the shorter S-N length in the Japanese sample reflects the increase in the angles of SNA and SNB. In the present study, there was no significant difference in the size of the mandible, although Ngan et al.[6] reported that the Chinese sample showed an increase in mandibular length when compared with that of the American Caucasian sample. The dental pattern showed a significant difference in inclination of incisors to the palatal and mandibular planes. The parameter of U 1-UR/ANS-PNS (palatal plane) showed a significantly proclined position of the upper incisors in the Japanese sample compared to that of the British Caucasians. The parameters of L 1-LR/ANS-PNS and L 1-LR/Go-Me (mandibular plane) showed a significantly retroclined position of the lower incisors in the Japanese sample compared to that of the British Caucasians. At the presurgical treatment planning, the problem of the dental compensation associated with the severity of skeletal Class III malocclusion had to be solved to achieve normal inclination of incisors to jaws (Figure 3). Skeletal Class III in Japanese may need more retroclination of the upper incisors and proclination of the lower incisors. Extraction of upper bicuspids and non-extraction of the lower arch could be recommended more often for Japanese than for Caucasians. At post-operation, the two ethnic groups showed a significant difference in the parameters of the points Me and Go to the mandibular plane angle (Go-Me/ANS-PNS), with in the Japanese sample increased (4 degrees) significantly to be associated with upward movement of the point Go, which is not a favorable change in skeletal Class III abnormalities. In contrast, the British sample showed downward movement of point Go and a slight upward movement of point Me associated with the unchanged mandibular plane angle.

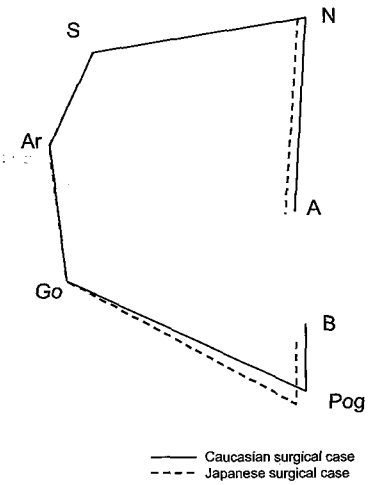

Fig.5 : Facial framework in Japanese and British Caucasians with severe skeletal Class III malocclusion.

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抄録：日本人と白人英国人における下顎前突症の外科矯正治療効果の差異

中村康洋（伊那市開業，長野県）
長田紀雄（那覇市開業，沖縄県）
飯田吉郎，飯田賀代（名古屋市開業，愛知県）
影山　徹（松本歯大，総歯研，硬組織疾患制御再建学部門，臨床病態評価学ユニット）
石井信行（兵庫県立小児病院，小児歯科）

本研究の目的は日本人と白人英国人間での下顎前突症の歯顎顔面形態の差異および外科矯正による治療効果の相違を側貌セファロX線写真を用いて検討した．

結果の要点をまとめると，

1．治療前の症例分析では，日本人の下顎前突症は白人と比較して，前脳頭蓋（S–N）の距離が短く有意差を示した（$p<0.001$）．

2．口蓋平面（ANS–PNS）に対する上顎切歯傾斜角は日本人で大きく，口蓋平面と下顎下縁平面角への下顎切歯傾斜角にも両群間で有意差を認めた（$p<0.001$）．

3．手術後1年の所見では，日本人は下顎下縁平面角の増大が治療前より顕著になり（NS，p<, 0.01 to 0.001），Go点に関わる計測項目（Go to ANS–PNS，Ar–Go）でも同じ結果を示した．