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Original Article

Influence of Mandibular Fixation Method on Stability of the Maxillary Occlusal Plane after Occlusal Plane Alteration

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Abstract

In this study, we investigated how method of mandibular fixation influenced long-term postoperative stability of the maxilla in Class III cases. In particular, we investigated change in the maxillary occlusal plane after Occlusal Plane Alteration. Therefore, we focused on change in the palatal plane to evaluate stability of the maxillary occlusal plane, as the position of the palatal plane affects the maxillary occlusal plane. This study included 16 patients diagnosed with mandibular protrusion. Alteration of the occlusal plane was achieved by clockwise rotation of the maxilla by Le Fort I osteotomy and mandibular setback was performed by bilateral sagittal split ramus osteotomy. We analyzed and examined lateral cephalometric radiographs taken at 1 month, 3 months, 6 months, and 1 year after surgery. Stability achieved by two methods of mandibular fixation was compared. In one group of patients (group S) titanium screws were used, and in the other group (group P) titanium-locking mini-plates were used. No significant displacement was recognized in group S, whereas an approximately 0.7 mm upward vertical displacement was recognized in the anterior nasal spine in group P. As a result, not only the angle of the palatal plane and S-N plane, but also occlusal plane angle in group P showed a greater decrease than that in group S. The results suggest that fixing the mandible with screws yielded greater stability of the maxilla and maxillary occlusal plane than fixing the mandible with titanium plates.

Key words: Occlusal plane alteration—Stability—Class III case—Mandibular fixation

Introduction

The purpose of orthognathic surgery is to harmonize functional occlusion with aesthetic appearance. However, as patient expectations rise, it is becoming more and more difficult to achieve the requisite level of harmony of both function and aesthetics. In orthognathic surgery, one-jaw surgery involving the mandible is common. Although a satisfactory maxillo-mandibular occlusal relationship may usually be obtained with such an approach, there are

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still cases where an aberration occurs in the occlusal plane. In such cases, surgery achieves neither satisfactory aesthetic results nor sufficient stability. Therefore, to achieve satisfactory improvement of the occlusal plane, two-jaw surgery is required, as it offers both better functional and aesthetic outcomes. The first report on occlusal plane alteration was that of McCollum *et al.*[11]. Further such studies were then carried out by Arpornmaeklong *et al.*[2], Chemello *et al.*[4], Proffit *et al.*[13], Reyneke[14], Reyneke *et al.*[15], and Wolford *et al.*[21,22]. These studies all reported better aesthetic and stability with this approach. However, most of these reports concerned skeletal Class II cases. Few reports have been made on skeletal Class III cases, and although the Epker[5] and Wolford *et al.*[20] studies are available for referencing the anterior standard, there are none for referencing the posterior standard in achieving improvement in the occlusal plane. Their indices for achieving an anterior standard involve measuring the distance from the upper lip to the lower lip and the tip of the upper central incisor. Therefore, Akimoto *et al.*[1] noted that the posterior standard for the occlusal plane would be the dens. In patients with normal bite, the posterior extension of the occlusal plane passes above the dens axis base, and in patients with skeletal Class III occlusion, it passes below the dens axis base (Fig. 1).

Rotating the occlusal plane clockwise is suggested to improve aesthetic outcome and function in skeletal Class III cases. Therefore, it is thought that occlusal alteration has high utility. However, if postoperative stability is not good, improved aesthetics and function cannot be maintained. There is no report on over one-year stability after occlusal plane alteration in Class III cases. Therefore, at first, we focused on whether mandibular stability affected stability of the maxilla. To achieve different degrees of mandibular stability, we used two methods of mandibular fixation. The purpose of this study was to investigate how method of mandibular fixation influenced long-term postoperative stability of the maxilla in Class III cases. In particular, we evaluated change in the maxillary occlusal plane after Occlusal Plane Alteration.

Patients and Methods

1. Patients

352 patients underwent two-jaw surgery for correction of skeletal Class III occlusion at Tokyo Dental College Hospital between 2002 and 2005. A total of 16 (3 men and 13 women) out of these were enrolled in the study. We limited the number of patients by strict criteria to perform better evaluation. Informed consent to participate in the study was obtained from all patients and parents of minor patients. Average age was 24.3 years. Criteria for inclusion in the study were as follows:

1) No basic asymmetry in their antero-posterior cephalometric radiographs, as reported by Fujinami *et al.*[6] (Figs. 2, 3).
2) A low occlusal plane angle, in which the posterior extension of the occlusal plane passed below the dens axis base in the patient's lateral cephalometric radiograph (Fig. 1).
3) Surgery was performed by an independent oral surgeon.

2. Surgery

All patients received preoperative and postoperative orthodontic treatment. In addition,

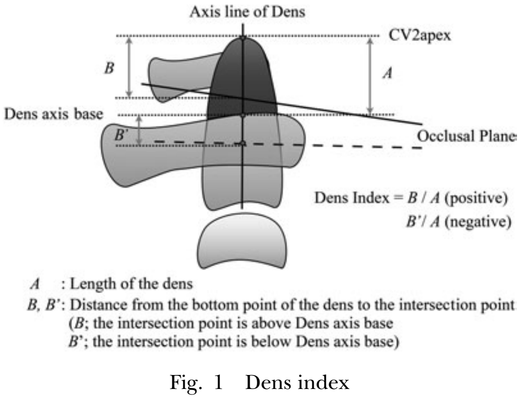

Fig. 1 Dens index
Axis line of dens is defined by the point of CV2 apex and the point of Dens axis base (base of dens).

model surgery followed the method reported in our previous study[23]. Surgery involved use of the two occlusal splints made during the model surgery.

Le Fort I osteotomy was performed on the maxilla and bilateral sagittal split ramus osteotomy was performed on the mandible. Three patients underwent genioplasty at the same time. Alteration of the occlusal plane was achieved by clockwise rotation of the maxilla by Le Fort I osteotomy, which moves the posterior nasal spine (PNS) in an upward direction. The setting basis of the occlusal plane followed the method of Akimoto *et al.*[1], which is based on the dens. However, the occlusal plane does not always move into the average position characteristic of normal occlusion, and the nasal airway, convexity and upper incisor angle after orthodontic treatment also require consideration in planning surgery. Reyneke[14] noted that a horseshoe-shaped osteotomy was required when impacts occurred above the nasal airway by 5–6 mm. That is to say, there is a limit to upper transposition of the posterior maxilla, so the occlusal plane will pass below the dens axis base (Fig. 4). In this study, the mandible was moved posteriorly according to the position of the maxilla, after which, it was fixed to obtain best occlusal position. Two resorbable plates (poly-L-lactic acid (PLLA) plate) and two 2.0 mm titanium-locking mini plates (plate) were used to fix a Le Fort I segment. Two different methods were used to fix the mandible. In one group of patients (group S: 8 patients) 2.4 mm titanium screws (screw) were used, and in the other group of patients (group P: 8 patients) plates were used. In addition, intermaxillary fixation was obtained on the next day after surgery using splints which were maintained for 5–7 days.

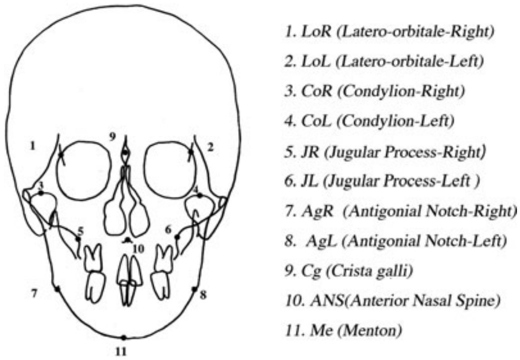

Fig. 2 Measurement landmarks of frontal cephalometric analysis

11 measurement landmarks for antero-posterior cephalometric radiographs.

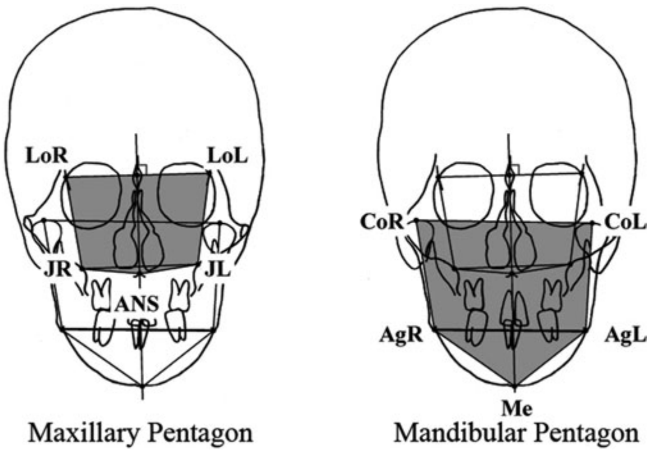

Fig. 3 Pentagon of maxilla and mandible

Pentagons were used to determine which patients had asymmetry. Where pentagon showed little variation from Fujinami's pentagon, patient was judged to have no asymmetry.

3. Cephalometric analysis

Lateral cephalometric radiographs were taken at before (PRE), and at 1 month (1M), 3 months (3M), 6 months (6M), and 1 year after surgery (1Y) for analysis. Sassouni arc analysis[17] and Ricketts analysis[16] were carried out on all lateral cephalometric radiographs. The measurement landmarks are shown in Figs. 2 and 5. A total of 13 measurement items were used to obtain a skeletal evaluation (Figs. 6, 7, 8). One of the main purposes of this study was to investigate postoperative stability of the maxillary occlusal plane, to evaluate which we used occlusal plane angle. However, postoperative stability of occlusal plane angle alone is insufficient to accurately indicate stability of the maxillary occlusal plane, for which reference to dental landmarks is necessary. Occlusal plane angle is also influenced by postoperative orthodontic treatment. Therefore, we also used the palatal plane to evaluate change in the maxillary occlusal plane, as change in the palatal plane accurately indicates rotation of the maxilla, with the maxillary occlusal plane rotating with change in the angle of the palatal plane.

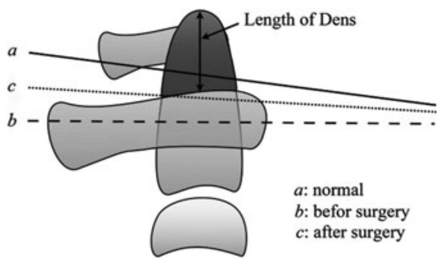

Fig. 4 Relationship between occlusal plane and dens
Dens index
a: M; 25.4 ± 39.3% F; 26.7 ± 34.2%
b: −39.1 ± 29.5%
(group S: −35.8 ± 41.9%; group P: −42.5 ± 9.4%)
c: −5.6 ± 30.5%
(group S: −0.9 ± 40.2%; group P: −10.3 ± 18.3%)

Quick Ceph 2000® (Quick Ceph® System, USA), a cephalometric analysis software, was used for the computer analysis.

In order to reduce error rates as much as possible, all lateral cephalometric radiographs were analyzed twice by the author alone. Mean average values used for the analysis were calculated from the results of two runs of each test.

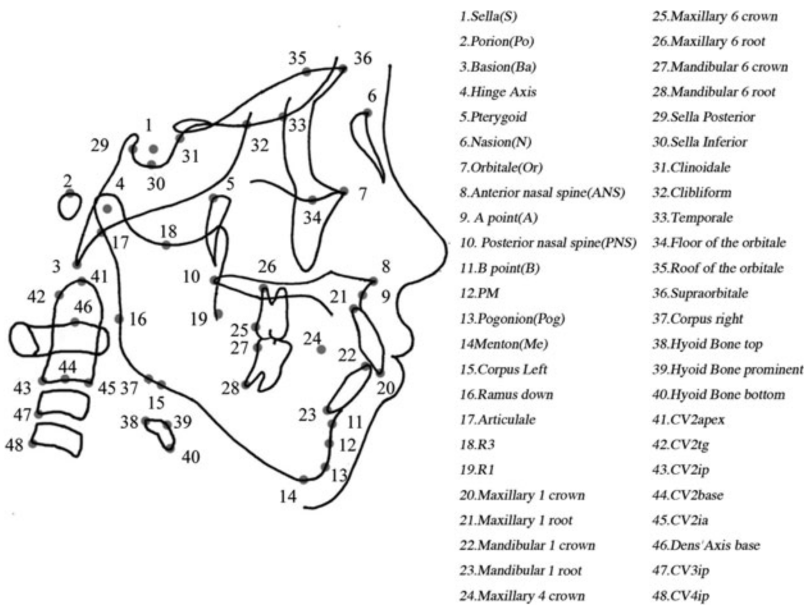

Fig. 5 Lateral reference landmarks
48 measurement landmarks for lateral cephalometoric radiographs.

4. Evaluation of measurement items

At first, we reviewed stability in all 16 patients. Next, we divided the 16 patients into 2 groups (group S and group P) according to type of mandible fixation and reviewed stability in both groups. Table 1 shows the details of

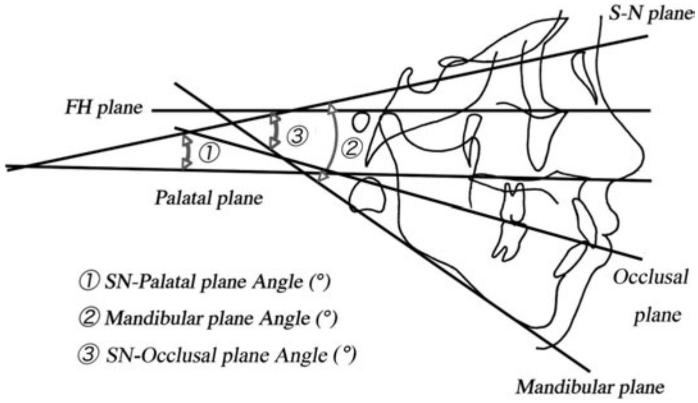

Fig. 6 Measurement items of angle

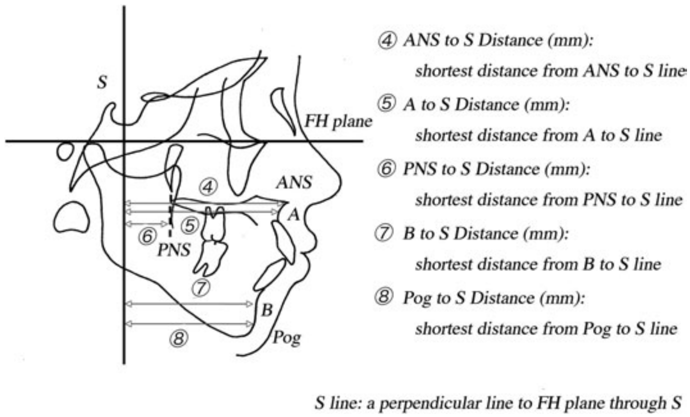

Fig. 7 Horizontal measurement items

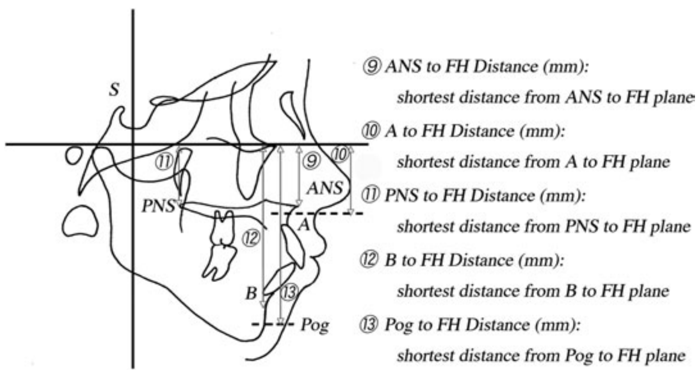

Fig. 8 Vertical measurement items

the two groups. The measured items in each group, from PRE to 1 M, 3 M, 6 M, and 1 Y, were analyzed and compared. Changes occurring over the postoperative course period were also compared between groups.

In addition, degree of transfer was determined by a comparison of the PRE and 1 M values. Degree of relapse was determined by comparing values obtained at 1M and 1Y. Many studies on postoperative stability used the period immediately after surgery as the base line. However, in this study, we wanted to observe long-term stability after immediately change. Therefore, we used 1 month as the

Table 1 Characteristics of group S and group P

		age	sex	Change of SN-palatal plane angle by operation (°)	B point transference to backward by operation (mm)
group S					
	1	20	F	4.6	8.3
	2	23	F	1.4	3.5
	3	29	M	0.7	9.5
	4	24	F	3.1	5.7
	5	32	F	4.6	6.0
	6	30	F	3.7	13.1
	7	22	F	2.8	6.4
	8	28	M	3.0	6.4
	average	26.0		3.0	7.4
group P					
	1	18	F	4.8	9.7
	2	21	F	2.3	7.9
	3	22	F	2.4	11.0
	4	21	F	5.7	2.8
	5	24	F	3.9	3.4
	6	23	M	2.1	16.6
	7	20	F	1.1	10.6
	8	30	F	2.5	5.7
	average	22.3		3.1	8.5

Table 2 Means and SDs in all patients

Measurement items	PRE Mean	(SD)	1M Mean	(SD)	3M Mean	(SD)	6M Mean	(SD)	1Y Mean	(SD)
Maxilla										
SN-Palatal plane Angle (°)	9.08	(3.93)	12.13	(4.07)	11.68	(3.88)	11.53	(3.85)	11.39	(3.78)
SN-Occlusal plane Angle (°)	14.8	(4.10)	17.73	(4.00)	17.39	(3.95)	17.39	(3.69)	17.29	(3.86)
ANS to S Distance (mm)	70.76	(4.93)	71.69	(5.26)	71.26	(5.17)	71.02	(5.09)	71.00	(4.85)
ANS to FH Distance (mm)	26.58	(3.45)	26.98	(3.55)	26.73	(3.52)	26.70	(3.56)	26.60	(3.62)
PNS to S Distance (mm)	20.86	(2.90)	22.14	(3.51)	22.03	(3.58)	22.07	(3.63)	22.17	(3.71)
PNS to FH Distance (mm)	25.77	(2.49)	23.46	(2.35)	23.56	(2.31)	23.73	(2.29)	23.84	(2.19)
A to S Distance (mm)	67.16	(5.07)	68.46	(5.09)	67.87	(4.91)	67.56	(5.05)	67.53	(4.94)
A to FH Distance (mm)	32.58	(3.32)	32.68	(3.23)	32.72	(3.53)	32.58	(3.14)	32.38	(3.23)
Mandible										
Mandibular plane Angle (°)	27.91	(3.68)	29.59	(4.55)	29.74	(4.33)	29.43	(4.42)	29.34	(4.56)
B to S Distance (mm)	74.59	(7.74)	66.68	(5.70)	67.01	(5.77)	67.30	(5.63)	67.55	(5.59)
B to FH Distance (mm)	76.43	(5.85)	74.35	(5.85)	73.55	(5.63)	73.49	(5.53)	73.31	(5.06)
Pog to S Distance (mm)	76.74	(8.45)	68.91	(6.28)	69.28	(6.49)	69.84	(6.27)	70.23	(6.47)
Pog to FH Distance (mm)	93.48	(6.72)	92.10	(6.34)	91.25	(6.59)	91.08	(6.50)	91.03	(6.49)

base line.

The nonparametric Wilcoxon matched pairs test and a single-ranks test were used in the statistical analysis to compare change between periods (1M–3M, 1M–6M, 1M–1Y). The SAS® (SAS Institute Inc., USA) Ver. 8.02 software was used. The level of significance was set at $p<0.05$.

Correlation coefficients between the degree of transfer and degree of mandibular relapse following surgery, and between degree of mandibular relapse and relapse of anterior nasal spine (ANS) and PNS of the maxilla were obtained.

Results

Table 2 shows the data on change during the postoperative observation period (1M–3M, 1M–6M, 1M–1Y) in all 16 patients. Table 3 shows the data on change during the post-

Table 3-1 Means and SDs of measurements in group S

Measurement items	PRE Mean	(SD)	1M Mean	(SD)	3M Mean	(SD)	6M Mean	(SD)	1Y Mean	(SD)
Maxilla										
SN-Palatal plane Angle (°)	9.96	(3.91)	12.95	(4.34)	12.69	(4.20)	12.54	(4.15)	12.56	(4.20)
SN-Occlusal plane Angle (°)	14.20	(4.39)	17.06	(4.38)	16.74	(4.40)	16.91	(4.55)	16.96	(4.97)
ANS to S Distance (mm)	70.95	(5.48)	71.50	(5.34)	71.06	(5.75)	70.64	(5.58)	70.75	(5.21)
ANS to FH Distance (mm)	27.48	(4.41)	27.83	(4.40)	27.59	(4.28)	27.70	(4.38)	27.76	(4.45)
PNS to S Distance (mm)	21.69	(2.82)	22.61	(3.50)	22.34	(3.70)	22.34	(3.58)	22.41	(3.62)
PNS to FH Distance (mm)	25.50	(2.64)	23.45	(2.69)	23.40	(2.75)	23.63	(2.66)	23.76	(2.62)
A to S Distance (mm)	68.24	(5.73)	68.69	(5.30)	68.43	(5.58)	68.34	(5.51)	68.18	(5.50)
A to FH Distance (mm)	33.21	(3.94)	33.31	(3.87)	33.40	(4.31)	33.15	(3.54)	32.94	(3.91)
Mandible										
Mandibular plane Angle (°)	27.36	(3.45)	27.99	(5.29)	28.23	(5.01)	27.95	(4.88)	27.76	(4.96)
B to S Distance (mm)	75.45	(8.40)	68.09	(7.21)	68.11	(7.53)	68.18	(7.36)	68.46	(7.33)
B to FH Distance (mm)	75.40	(5.03)	73.78	(5.25)	73.30	(5.28)	73.04	(5.03)	73.08	(4.62)
Pog to S Distance (mm)	76.65	(8.43)	70.34	(7.92)	70.30	(8.36)	70.71	(8.07)	70.79	(8.16)
Pog to FH Distance (mm)	92.00	(7.20)	90.86	(6.85)	90.15	(7.42)	89.75	(7.25)	90.16	(7.37)

Table 3-2 Means and SDs of measurements in group P

Measurement items	PRE Mean	(SD)	1M Mean	(SD)	3M Mean	(SD)	6M Mean	(SD)	1Y Mean	(SD)
Maxilla										
SN-Palatal plane Angle (°)	8.20	(4.01)	11.30	(3.88)	10.70	(3.51)	10.50	(3.49)	10.21	(3.14)
SN-Occlusal plane Angle (°)	15.51	(3.94)	18.61	(3.41)	18.14	(3.55)	17.91	(2.64)	17.66	(2.39)
ANS to S Distance (mm)	70.56	(4.69)	71.88	(5.34)	71.46	(4.92)	71.40	(4.91)	71.25	(4.80)
ANS to FH Distance (mm)	25.69	(2.07)	26.14	(2.46)	25.86	(2.56)	25.70	(2.37)	25.44	(2.27)
PNS to S Distance (mm)	20.03	(2.91)	21.66	(3.68)	21.71	(3.68)	21.80	(3.91)	21.88	(3.95)
PNS to FH Distance (mm)	26.04	(2.49)	23.46	(2.16)	23.73	(1.96)	23.83	(2.03)	23.91	(1.86)
A to S Distance (mm)	66.44	(4.27)	67.64	(4.81)	67.24	(4.44)	67.04	(4.68)	67.04	(4.65)
A to FH Distance (mm)	31.94	(2.69)	32.04	(2.54)	32.04	(2.66)	32.01	(2.81)	31.91	(2.42)
Mandible										
Mandibular plane Angle (°)	28.46	(4.06)	31.20	(3.25)	31.26	(3.15)	30.91	(3.61)	30.93	(3.77)
B to S Distance (mm)	73.74	(6.89)	65.28	(3.64)	65.90	(3.46)	66.43	(3.48)	66.61	(3.36)
B to FH Distance (mm)	77.46	(6.93)	74.98	(6.63)	73.69	(6.32)	73.94	(6.31)	73.54	(5.78)
Pog to S Distance (mm)	76.83	(9.06)	67.48	(4.14)	68.26	(4.24)	69.09	(4.17)	69.66	(4.74)
Pog to FH Distance (mm)	93.74	(5.74)	92.59	(6.03)	91.53	(5.90)	91.57	(5.76)	91.00	(5.72)

operative observation period in both groups. Table 4 shows the results of the statistical analysis by the Wilcoxon matched pairs test. Figs. 9, and 10 S and P show the changes in degree of transposition with surgery and after surgery.

1. Maxilla

With clockwise rotation of the maxilla, PNS moved about 2–2.5 mm upward, ANS slightly moved about 0.4–0.5 mm downward, and the angle of the palatal plane and S-N plane increased by approximately 3° (PRE-1 M) in both groups. The angle of the occlusal plane and S-N plane also increased by approximately 3°. After surgery (1 M–1Y), neither group showed significant antero-posterior change, although slight vertical change downward was recognized at PNS. ANS moved about 0.9 mm backward 1 year after surgery in both groups. Although no vertical change was seen in group S, an approximately 0.7 mm movement upward was recognized in group P at ANS at 1 year after surgery. As a result, counter-clockwise rotation of the palatal plane was recognized in both groups, together with a decrease in the angle of the palatal plane and S-N plane. The quantity of the latter was about 0.4° in group S and about 1.0° in group P. A correlation between degree of mandibu-

Table 4 Significant differences between group S and group P

	Groups	PRE–1 M	1 M–3 M	1 M–6 M	1 M–1Y
Measurement Items of Maxilla					
SN-Palatal plane Angle (°)	S	*	*	*	*
	P	*	*	*	*
SN-Occlusal plane Angle (°)	S		*		
	P	*	*	*	*
ANS to S Distance (mm)	S			*	*
	P				*
ANS to FH Distance (mm)	S				
	P				*
PNS to S Distance (mm)	S				
	P	*			
PNS to FH Distance (mm)	S	*			
	P	*			*
A to S Distance (mm)	S				
	P	*		*	*
A to FH Distance (mm)	S				
	P				
Measurement Items of Mandible					
Mandibular plane Angle (°)	S				
	P	*			
B to S Distance (mm)	S	*			*
	P	*	*	*	*
B to FH Distance (mm)	S	*			
	P	*	*		
Pog to S Distance (mm)	S	*			*
	P	*		*	*
Pog to FH Distance (mm)	S				
	P				

*: $p<0.05$

lar relapse and relapse of ANS and PNS of the maxilla was recognized (ANS: $R^2 = 0.455$, PNS: $R^2 = 0.5371$).

2. Mandible

At the B point and pogonion, antero-posterior change was posterior and vertical change was upward with surgery (PRE-1 M). Although after surgery (1 M–1Y), vertical change at both the B point and pogonion tended to be in the upward direction, no significant difference was recognized at any of the set time periods. Antero-posterior change in group S advanced slightly in one year. As with group P, in every period, advancement was significant, at about 1.4 mm at B point and at about 2.0 mm at the pogonion 1 year after surgery. No significant change was seen in the mandibular plane in either group. No correlation was recognized between degree of transposition by surgery and degree of mandibular relapse after surgery ($R^2 = 0.1214$).

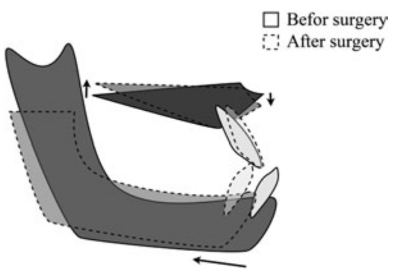

Fig. 9 Transposition by operation

Discussion

Two-jaw surgery involving occlusal plane alteration requires more aggressive surgery. Anatomical considerations such as the descending palatine artery in the vicinity of the posterior maxilla make surgery difficult, requiring a high level of expertise. However, several reports have suggested that alteration of the occlusal plane is highly effective in obtaining good aesthetic and functional outcomes. Kusakabe *et al.*[9] and Reyneke *et al.*[15] suggested that this approach was necessary in altering chin projection to achieve good aesthetic results, as it cannot be obtained by one-jaw surgery alone. In terms of functional outcome, Motoyoshi *et al.*[12] noted that in making the occlusal plane angle high, it formed a right angle with the vector derived from the masseter. When the occlusal plane was flat, occlusal pressure concentrated around the molars was dispersed throughout the entire dentition. In other words, they found that neuromuscular balance was maintained by positioning the occlusal plane at an appropriate vertical position. Therefore, it is thought that occlusal alteration has high utility. However, it is a necessary condition that postoperative stability is good. There are many factors that influence stability. Surgical influences were excluded as much as possible through patient selection criteria in this study. We noted the influence of mandibular fixation on postoperative stability.

In conclusion, the occlusal plane after

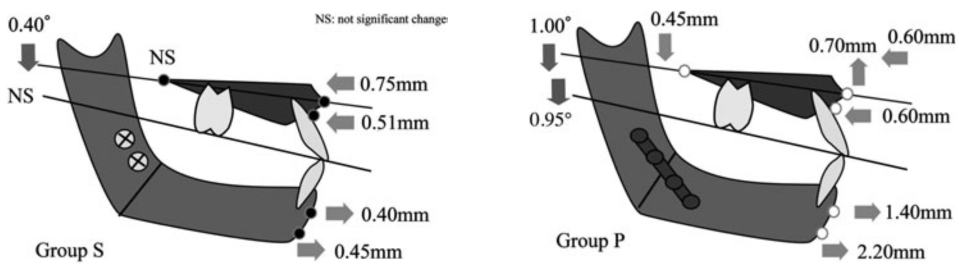

Fig. 10 Position change after operation (group S and group P)
Direction and average value of change at 1 Y of points are shown. Points represent measurement items showing significant change.

clockwise rotation showed significant change in group P at one year after surgery. In other words, fixing the mandible with screws yielded greater stability of maxillary occlusal plane angle than fixing the mandible with titanium plates. However, this result is not necessarily correct. As described above, the occlusal plane is decided by dental landmarks and can easily be influenced by postoperative orthodontic treatment. Therefore, we also evaluated changed in the landmarks of the mandible and maxilla after surgery.

In terms of mandibular stability, the degree of relapse in groups where screws were used in previous reports[10,18,21] was similar to that of group P in this study. Fixation using locking plates may be the reason good stability of the mandible was obtained in group P. In this study, locking plates were used to fix the mandible. To the author's knowledge, there have been no other studies on fixation using locking plates in orthognathic surgery. However, physiological research on locking plates revealed[8] that the screw locking into the plate on each side of the fracture, as well as into the bone, resulted in the construction of a highly stable frame. Several studies on bone fractures have also found[7,19] that such locking plates were stable. Compression of the locking plate on the bone decreases depending on the construction of the plate. Therefore, the risk of primary loss of reduction is suppressed and bone blood supply is preserved. This is the reason locking plates are considered to be stable. Moreover, the stability of group S was more stable. The degree of relapse in group S in this study was only 0.45 mm at the pogonion. It was thought that this good stability might have resulted from the alteration of the occlusal plane. According to Proffit *et al.*[13], moving the maxilla upwardly and the mandible posteriorly in patients with Class III occlusion led to shortening of mandibular muscle, yielding control of muscle tension, together with soft tissue relaxation due to autorotation. This resulted in a decrease in force against the maxilla and mandible. Therefore, good mandibular stability was achieved. However, further research is needed to clarify the relationship between stability and occlusal alteration. In terms of mandibular stability, group P showed a more significant relapse than group S. This finding agrees with that of earlier reports.

In terms of maxillary stability, it should be noted that this difference in stability was revealed through fixation of the mandible. In group P, in particular, relapse of the maxilla after surgery occurred in an upper direction at ANS, and in a downward direction at PNS. As a result, group P showed greater counterclockwise rotation of the palatal plane and change in occlusal plane angle than group S. According to Bothur *et al.*[3], no change in maxillary stability was seen in a comparison of two-jaw and one-jaw surgery of the maxilla. Therefore, they suggested that the mandible does not influence maxillary stability. Regarding relapse of the maxilla and mandible, Marchetti *et al.*[10] suggested that the maxilla or mandible influence each other, although this remains to be clarified. Unlike the mandible, there is no strong muscle such as the masseter attached to the maxilla, so influence from muscle is considered to be less. Considered alone, good stability can be predicted in the maxilla. However, the maxilla always receives pressure due to occlusion from the mandible. This occlusion exerts its force vertically and antero-posteriorly on the maxilla. Therefore, we suggest that occlusion and degree of mandibular relapse influence the stability of the maxilla. It was anticipated that anterior movement of the mandible after surgery would push the maxillary front teeth upward. As a result, vertical relapse of the maxillary front in group P was especially large. Therefore, in terms of obtaining maxillary stability after surgery, we believe that the maxilla should be considered in conjunction with the mandible, not alone. The maxilla and mandible should be considered as a complex. Therefore, in occlusal plane alteration cases, it is important to fix the mandible rigidly. We suggest that to the optimum method is to use a screw for mandibular fixation. If a plate must be used, we recommend a locking plate be used rather than a conventional plate.

Conclusion

We investigated how method of mandibular fixation influenced long-term postoperative stability of the maxilla in Class III cases and how that affected the maxillary occlusal plane.

Stability of not only the mandible but also the maxilla was greater with use of a screw than of a plate in fixing the mandible, as was stability of the occlusal plane angle. Therefore, rigid fixation of the mandible is necessary in order to avoid long-term counter-clockwise rotation of the maxilla following surgery in which occlusal plane alteration is performed. Rigid mandibular fixation is one of the most important factors in achieving good stability of the maxillary occlusal plane and in preserving the aesthetic and functional benefits obtained by Occlusal Plane Alteration.

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