

A case report of nonsurgical orthodontic treatment of a severe class III malocclusion patient with cleft lip and palate for 19 years

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Abstract : Malocclusions such as anterior and/or posterior crossbite are often caused by the abnormal growth of the maxilla following the surgery of unilateral cleft lip and palate patient. In these patients, we have successfully treated in four stages from infancy to adulthood. The first stage is preoperative maxillary orthopedic treatment for newborns before cheiloplasty, and the observation of their maxillary growth and occlusion. The second stage begins with maxillary expansion and/or protraction. The third stage is the alignment of the permanent teeth using a multibracket system. The last stage includes retention, prosthodontic treatment and long-term observation.

In this study, we observed a case of severe class III malocclusion and evaluated the effect of orthodontic treatment, from the second stage to the fourth stage over a period of 19 years. At the first medical examination, the patient was a girl, 12 years 11 months old, with a complete left cleft lip and palate, and had a concave facial profile and a severe Class III malocclusion. Total active treatment time was 5 years and 7 months. Although we could not obtain a skeletal improvement by orthodontic treatment, anterior cross bite was improved mainly due to the anterior tooth movement. The skeletal change, from 19 to 32 years old, was almost unnoticeable, while slight changes were visible in the anterior tooth incisal inclination. Therefore, we consider that a longer period of retention and observation is necessary to check the stability of the resulting occlusion.

Key words : Cleft lip and palate patient, Skeletal class III, Nonsurgical orthodontic treatment

Introduction

Cleft lip and palate are congenital craniofacial malformations with an incidence of 0.85 to 2.68 per 1,000 in Japanese.¹⁾ Most patients with cleft lip and palate undergo plastic surgery for the closure of clefts at the initial stage of a series of treatments. Malocclusions such as anterior

and/or posterior crossbite, however, are often caused because the development of the maxilla in patients is frequently inhibited in the sagittal and transverse directions by scar tissue formation following the surgery.

In such cases, the inhibition of maxillary growth following surgical repair of unilateral clefts has been documented.^{2,3,4)}

Most patients with a cleft lip and palate

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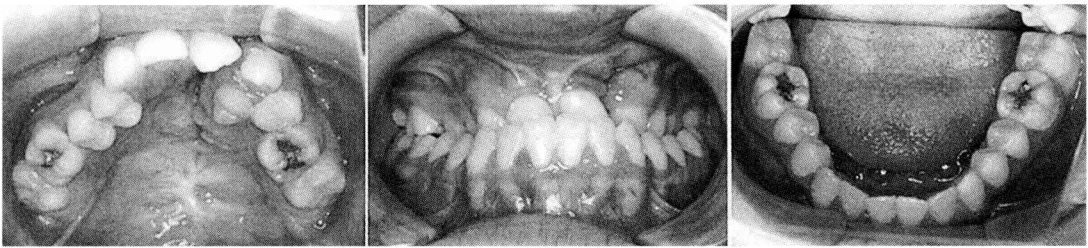


Fig. 1. Pre-treatment intraoral photographs

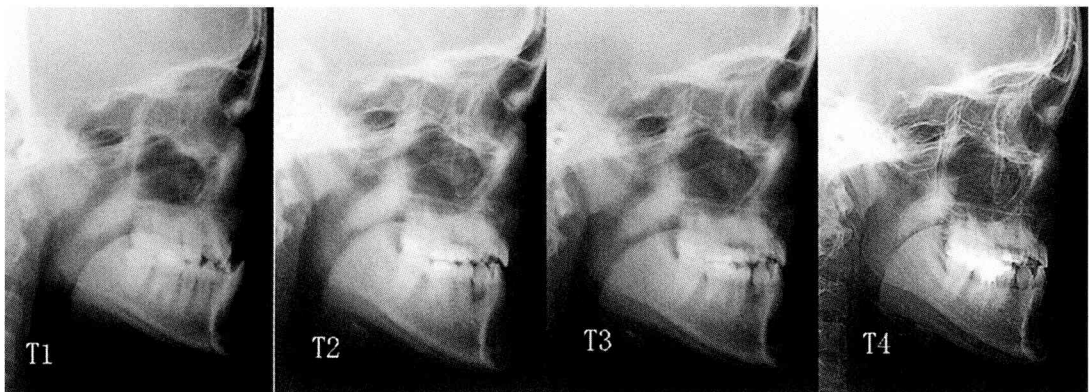


Fig. 2. Roentgenographic cephalogram

T 1 : Pre-treatment (12 years 11 months of age)

T 2 : Beginning of retention (18 years 9 months of age)

T 3 : 1 year retention (19 years 9 months of age)

T 4 : Post-treatment (before closure of fistula, 31 years 11 months of age)

exhibit mandibular prognathism. They need orthodontic treatment to acquire a good functional occlusion.

The purpose of this article is to present the progress over 19 years on a patient with unilateral cleft and palate after orthodontic and orthopedic intervention.

Patient's History

The patient, a girl 12 years 11 months of age, was first referred to the Dental Hospital, Iwate Medical University, in April, 1978 for orthodontic treatment. She was born on May 16, 1965, with a complete left unilateral cleft of the lip, alveolar process, and palate after a normal full-term and delivery. The lip and alveolus were repaired at the age of 3 months, whereas the hard and soft palates

were primarily repaired at 1 year 1 month in other medical institutions. There was no known familial incidence of cleft.

Examination

The patient was first seen at our clinic with a mesognathic, concave, soft-tissue facial profile with insufficient support for the upper lip. She had a permanent stage of dental development. Molar relationships were Class III malocclusion bilaterally. There was an anterior crossbite with the maxillary anterior teeth completely contained behind the mandibular anterior teeth (Fig. 1). A lingual crossbite extended from the maxillary right second premolar to the maxillary left first molar. The maxillary left first premolar had erupted palatally

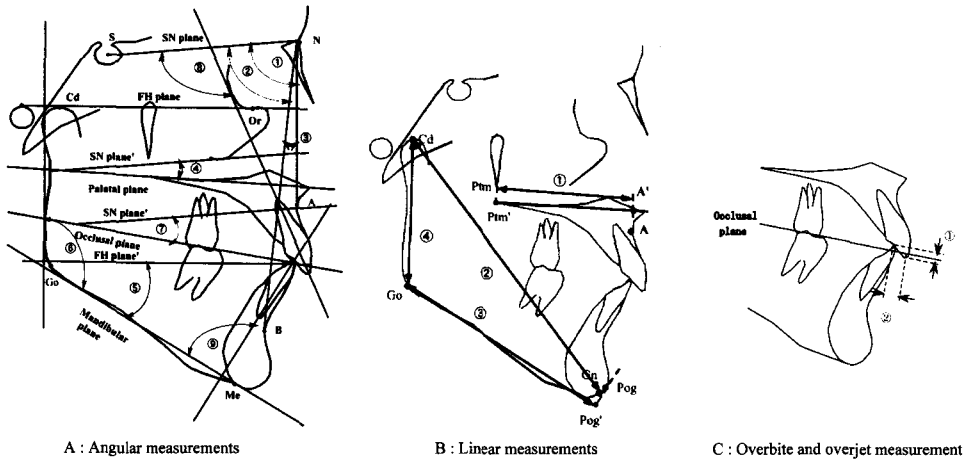


Fig. 3. Measurement variables of roentgenographic cephalogram.

- A : Angular measurements (degree)
- ①: SNA ②: SNB ③: ANB ④: Palatal plane ⑤: Mand. plane
- ⑥: Gonial angle ⑦: Occl. Plane ⑧: U-1 to SN ⑨: L1 to SN
- B : Linear measurements (mm)
- ①: A'-Ptm' ②: Gn-Cd ③: Pog'-Go ④: Cd-Go
- C : Analysis of overbite and overjet (mm)
- ①: Overbite ②: Overjet

Table 1 Cephalometric analysis

Variables	T1 (mean)	T2	T3	T4
SNA (°)	79.5 (81.5)	79.4	80.2	80.4
SNB (°)	84.4 (77.1)	85.3	85.7	85.9
ANB (°)	-4.9 (4.4)	-5.9	-5.5	-5.5
Palatal pl to SN (°)	9.0 (7.8)	6.5	7.8	7.0
Mand. pl angle (°)	22.9 (33.9)	20.0	19.6	20.4
Gonial angle (°)	123.6 (131.0)	120.0	119.4	119.6
Occlusal plane (°)	10.5 (20.2)	4.0	3.1	2.0
U1 to SN (°)	107.8 (105.4)	119.2	116.7	115.7
L1 to Mand. pl. (°)	87.5 (95.4)	68.8	68.7	70.0
A' - Ptm' (mm)	45.0 (46.3)	45.3	46.1	44.5
Gn - Cd (mm)	120.0 (114.5)	126.8	127.2	126.5
Pog' - Go (mm)	83.0 (74.9)	86.5	86.0	86.3
Cd - Go (mm)	56.7 (57.5)	61.5	61.9	61.4
overbite (mm)	5.9	2.6	2.6	1.8
overjet (mm)	-5.0	2.1	1.6	0.9

T 1: Pre-treatment (12 years 11 months)

T 2: Beginning of retention, all appliances removed (18 years 9 months)

T 3: 1 year retention (19 years 9 months)

T 4: Post-treatment, before the closure of the fistula in the palate (31 years 11 months)

while both maxillary lateral incisors were missing congenitally. The maxillary left central incisor was distally tilted. In addition, she had a fistula in the palate.

Cephalometric Analysis

Cephalometric measurements were performed as shown in Fig. 2 and Fig. 3. Four linear and nine angular measurement

Table 2 Dental cast analysis

Variables	t 1	t 2	t 3	t 4
3—3	23.1	27.0	29.1	28.5
5—5	35.9	41.7	42.8	42.1
6—6	46.5	50.6	51.2	51.1
7—7	57.7	60.3	60.5	60.2
7—1	35.0	40.0	40.0	39.5

t 1: Pre-treatment (13years)

t 2: Beginning of retention, all appliances removed
(18 years 9 months)

t 3: 1 year retention (19 years 9 months)

t 4: Post-treatment, after the closure of the fistula in the palate
(32 years 4 months)

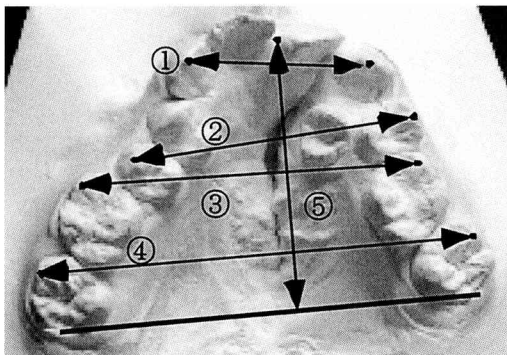


Fig. 4. Dental cast measurements (mm)

- ①: 3 - 3 Maxillary intercanine width
- ②: 5 - 5 Maxillary interpremolar width
- ③: 6 - 6 Maxillary inter-firstmolar width
- ④: 7 - 7 Maxillary inter-secondmolar width
- ⑤: 7 - 1 Dental arch length

items were analyzed for morphometric evaluation of the maxilla and mandible (Fig. 3-A and 3-B). They indicated that the maxilla was underdeveloped in the antero-posterior direction and the mandible was severely over-grown in antero-posterior direction : The SNA angle was 79.5°. The SNB angle was 84.4°. The ANB angle was - 4.9°. A'-Ptm' was 45mm. Gn-Cd was 120.0mm. Dental cephalometric appraisal showed the mandibular incisors were severely retroclined relative to the mandibular plane : U 1 to SN was 107.8° and L 1 to Mandibular plane was 87.5°. Overjet was - 5 mm while overbite was excessive and reversed with

half of the maxillary incisor crowns covered (Table 1 and Fig. 3 -C).

Dental casts : Analysis

Dental cast measurements were performed as shown in Fig. 4. The maxillary dental arch widths and length are shown in Table 2. They indicate that the maxillary arch was constricted and exhibited a medially collapsed lesser segment and the maxillary arch form was V-shaped, and the maxillary buccal segments were collapsed.

Diagnosis

As mentioned above, the patient was diagnosed with anterior crossbite due to the over-growth of the mandible with constriction of the maxilla following surgical repair of the cleft lip and palate.

The treatment plan

The patient and her family did not hope to have a surgical treatment.

The primary treatment objectives for this patient were to orthopedically promote maxillary growth and development as much as possible, and to reposition the mandible down and backwards. The second treatment objectives were to re-establish the correct maxillary arch form and to expand the

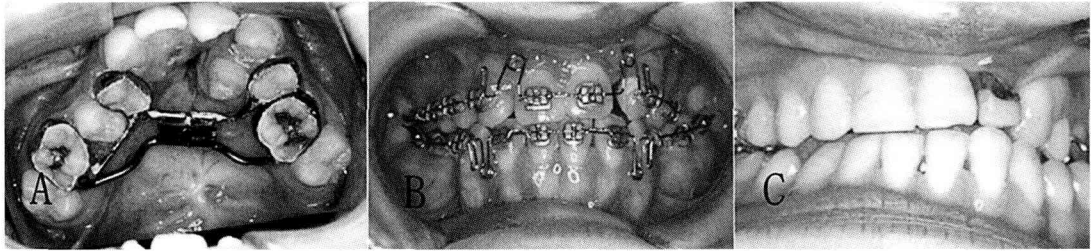


Fig. 5. Appliances
 A : Rapid expansion appliance
 B : Multibracket appliance
 C : Maxillary Hawley retainer with an acrylic tooth

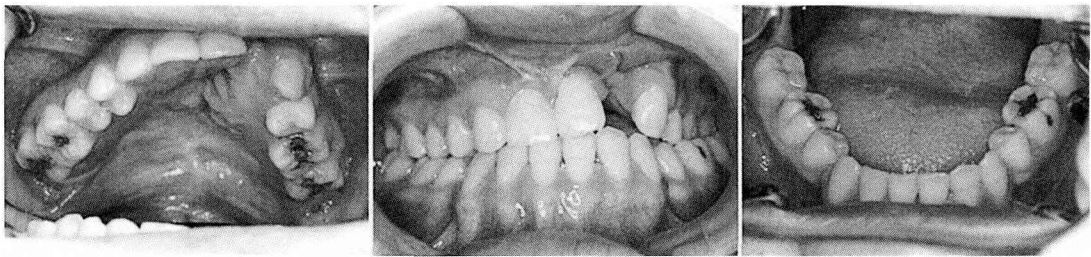


Fig. 6. Beginning of retention intraoral photographs

collapsed maxillary buccal segments by placing a rapid expansion banded to the right and left premolars and molars.⁵⁾ During this time, the upper central incisors were rotated and subsequently advanced to the tip of the maxillary anterior teeth.

The final treatment goals were to correct the crossbite and to position the maxillary teeth adjacent to the cleft so as to fabricate a prosthesis to replace the maxillary left lateral incisor. An additional goal was to achieve a functionally stable occlusion with appropriate overbite and overjet.

Progress of treatment

Treatment began with a fixed expansion appliance to correct the buccal crossbites and increase maxillary arch length (Fig. 5 -A). In addition, an extraoral appliance was used to prevent mandibular development. Initially, a chin cap/reverse headgear was

worn. The patient remained on chin cap therapy throughout treatment with instructions to wear the appliance 10 to 12 hours per day until June of 1982. Thereafter a multibracket appliance was used, between August of 1981 and February of 1984, advancing the maxillary arch forward to gain arch length (Fig. 5 -B). Due to the severe arch length discrepancies, the mandibular bilateral first premolars and the maxillary left first premolar were extracted. Standard edgewise mechanics were used to bring the erupting permanent dentition into a good functional occlusion. Crossbite correction and extraction space closure were achieved by continuous wearing of Class III intermaxillary elastics. This helped the mesial movement of the maxillary first permanent molars, labial tipping of the maxillary incisors, and retroclination of the mandibular anterior segment to correct the

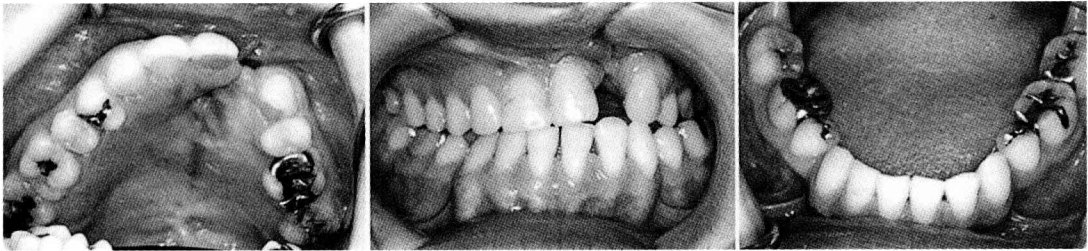


Fig. 7. Post-treatment intraoral photographs

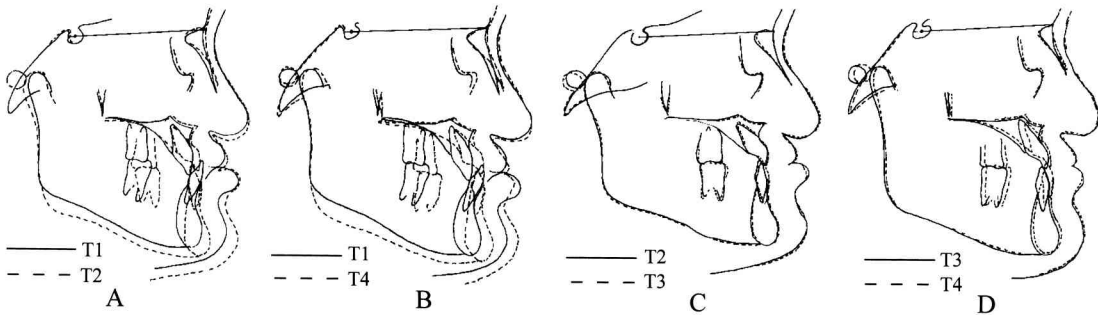


Fig. 8. Cephalometric superimposition

- T 1 : Pre-treatment (12 years 11 months of age)
- T 2 : Beginning of retention (18 years 9 months of age)
- T 3 : 1 year retention (19 years 9 months of age)
- T 4 : Post-treatment (before closure of fistula, 31 years 11 months of age)

crossbite and close the extraction sites.

Since the anterior crossbite was improved and occlusion became stable, we went into the retention, although the left posterior crossbite of the patient remained (Fig. 6). The appliances were removed after 5 years and 7 months of active treatment. In February of 1984, the multibracket appliance was removed and the patient was retained with a removable maxillary Hawley appliance. A Hawley retainer was placed in the mandible, while a maxillary Hawley retainer incorporating an acrylic tooth to replace the maxillary left lateral incisor was used on a full-time basis (Fig. 5-C). The patient came to receive treatment for the retention for one year, but then did not come for treatment because of her family reasons.

The patient returned for a post-treatment visit in 1997, showing little or no relapse of the maxilla and mandible, because she continued to wear a maxillary removable appliance that acted as an obturator for an oronasal fistula and prosthodontically replaced teeth in the area of the cleft.

At that time, the patient was anxious about the fistula of the palate, and hoped to close the fistula.

Treatment results

The patient still showed mandibular protrusion in profile, but the anterior crossbite was improved (Fig. 7). Pre-treatment and post-treatment superimpositions and cephalometric analysis are presented in Fig. 8 and Table 1.

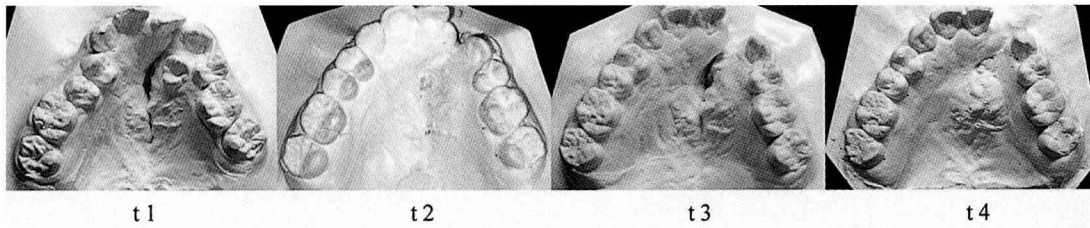


Fig. 9. Occlusal view of maxillary dental cast

t 1 : Pre-treatment

t 2 : Beginning of retention

t 3 : 1 year retrntion

t 4 : Post-treatment (after closure of the fistula, 32 years 4 months old)

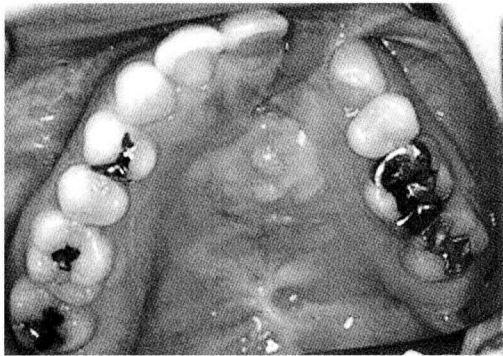


Fig. 10. Intraoral view of the maxillary arch after fistula closure in the palate, 32 years 4 months old

Total active treatment time was 5 years and 7 months. Superimposition of the tracing of the pre-treatment and retention lateral cephalograms show noted improvement in the dental relation and favorable downward and forward growth of the mandible (Fig. 8-A).

The stability of the treatment was shown in the superimpositions of tracings of retention and post-treatment (Fig. 8-D). As expected with a nongrowing patient, there were no changes in any skeletal cephalometric measurements after retention. The palatal plane was changed in a downward and forward direction, which might be due to the effect of the Class III intermaxillary elastics.

By measuring the dental cast, the maxillary dental arch widths were found to have expanded laterally by 3 to 6 mm during the active treatment period, and the maxillary dental arch length was expanded by about 5 mm. These were also mostly maintained thereafter (Table 2 and Fig. 9).

The patient underwent closure of the fistula in the palate in May, 1997 (Fig. 10).

Discussion

Skeletal maxillary retrusion and mandibular protrusion of the patient were treated with an extraoral orthopedic appliance in conjunction with standard edgewise mechanics. Bishara, et al.⁶⁾ reported that SNA normally decreases in patients with repaired unilateral clefts of the lip and palate. However, cephalometrically, an increase in the SNA angle of approximately 1° was observed in this patient. Then her mandibular plane angle was lower than the mean value, and this contributed to the favorable growth of the mandible, and the downward and forward growth of the mandible, in accordance with Nanda's⁷⁾ suggestion that the mandibular plane angle is a prognostic criterion for predicting the degree, proportion, and direction of facial growth.

Originally, improvement of the occlusion

including the surgical treatment may have been necessary for this case. As Hotz et al.⁸⁾ and Kinno et al.⁹⁾ advocated, it is necessary to control the occlusion immediately after birth, to obtain favorable growth of the maxillofacial bones.

However, treatment from an early stage sometimes becomes a big burden to the patient and family. Therefore, when an orthodontic treatment is started early, the orthodontist must grasp the life environment of the patient and family fully, and it is especially necessary to provide clarifications about the necessity of treatment to the patient's parents.

Conclusions

The process of the treatment for the cleft lip and palate with severe skeletal reverse occlusion for 19 years, from 13 years to 32 years of age, was observed. The patient had been presented that a skeletal maxillary retrusion and mandibular protrusion was initially treated with an extraoral orthopedic appliance in conjunction with standard edgewise mechanics. Originally, improvement of the occlusion including surgical treatment might have been necessary for this case. However, orthodontic treatment was started with an orthodontic-only approach. Although we could not achieve a skeletal improvement by orthodontic treatment, the anterior crossbite was improved mainly due to the anterior

tooth movement. The skeletal change after orthodontic treatment was almost unnoticeable, while several changes were noticeable in the anterior tooth incisal inclination. Therefore, we consider that a longer period of retention and observation is necessary to check the stability of the resulting occlusion.

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非観血的治療により著しい骨格型反対咬合を改善した唇顎口蓋裂患者の19年間の治療経過について

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抄録:片側性唇顎口蓋裂患者は手術後の上顎の劣成長により、しばしば前歯部および臼歯部反対咬合の不正咬合が生じる。そのため、我々は唇顎口蓋裂患者においては、出生直後から成人に至るまで四期に分けて非観血的矯正治療を行っている。すなわち、第一期は口唇形成手術前の患児に対して行う術前顎矯正治療や術後の顎発育の経過観察を行う時期である。第二期は乳歯咬合完成後に行う上顎側方拡大や顎発育の成長誘導の治療を行う時期である。第三期はマルチブラケット装置を用いて永久歯列の再排列を行う時期である。第四期は永久歯列の再排列後の保定と、その後の補綴治療と長期的観察を行う時期である。

今回、我々は二期から四期の19年間にわたり、著しい骨格型反対咬合の唇顎口蓋裂患者を観察し、矯正治療の効果について評価した。

患者は、初診時12歳11か月の左側唇顎口蓋裂の女子である。側貌は中顔面部が陥凹し、著しい反対咬合を呈していた。患者の動的治療期間は5年7か月であった。矯正治療により骨格的な改善は獲得できなかったが、被蓋は主に前歯の移動で改善された。19歳から32歳までの経過では、骨格的な変化はほとんど認められなかったが、前歯部の歯軸の変化が認められた。

したがって、獲得した咬合を安定させるために、さらに長期間の保定と観察が必要であると考えられる。

キーワード:唇顎口蓋裂患者, 骨格型反対咬合, 非観血的矯正治療