Orthodontic treatment of patients with skeletal class III down syndrome : case reports

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Introduction

Down syndrome(DS) is the most common chromosomal abnormality in humans, affecting around 1 in 600 to 1 in 2000 live births. It is result from extra copy of chromosome 21, translocation, mosaicism, or partial trisomy. Because of additional chromosome 21, DS patients have various clinical conditions like Alzheimer's disease, heart defects, non-inherited mental retardation, leukemia, hypertension and gastrointestinal problems. In oral and maxillofacial area, patients with DS have several properties related to periodontal disease, dental caries, craniofacial feature, occlusion and dental anomalies. Children with DS show small craniofacial complex with brachycephaly, cranial base flattening, small sella turcica. Also, they have maxillary anterior posterior hypoplasia, so 54% of DS patients have angle class III tendency, and maxillary transverse hypoplasia causes 65% of DS patients to have posterior crossbite. For skeletal class III malocclusion, the most commonly used treatment protocol is rapid palatal expansion(RPE) and facemask(FM) therapy. This research presents two cases of maxillary retrognathic skeletal class III down syndrome patients who treated with RPE/FM.

Case 1

Patient information

Age/Sex : 8Y 10M / M

PMH : imperforate anus(s/p anoplasty), Patent ductus arteriosus (PDA ligation), obstructive sleep apnea (Tonsillectomy and adenoidectomy)

CC : delayed eruption of maxillary anterior teeth, tooth grinding

◆ Problem list
- Skeletal class III with a retrognathic maxilla
- Anterior cross bite(#11,41)
- Posterior open bite
- Traumatic occlusion(#41), mobility(+)

Fig 2. pre-treatment cephalometric

Orthodontic treatment

♦ Bonded RPE and facemask were chosen as a treatment method. Bonded RPE with vestibular hook was delivered, and a facemask was delivered 2 weeks later. Bonded RPE was activated twice per week, until the optimal transverse dimension was achieved. Two months later, the bonded RPE had fallen out, and had perforation, so we remake the appliance with the same design. Nine months after FM placement, the maxillary anterior traction was achieved as desired, debonding of RPE was performed.

Fig 4. post-treatment cephalometric

		Pre-treatment		Post-treatment	
		Mean ± SD	Patient(Deviation)	Mean ± SD	Patient(Deviation)
Skeletal measures	SNA(°)	81.0 ± 2.7	76.7 (-1.6)	81.0 ± 2.7	79.2 (-0.7)
	SNB(°)	78.5 ± 2.7	77.1 (-0.5)	78.5 ± 2.7	75.4 (-1.1)
	ANB(°)	2.5 ± 2.0	-0.4 (-1.4)	2.5 ± 2.0	3.8 (0.6)
	Wits appraisal(mm)	-2.0 ± 2.0	-6.8 (-2.4)	-2.0 ± 2.0	-4.0 (-1.0)
	Maxillary depth(°)	91.3 ± 3.0	91.1 (-0.1)	91.3 ± 3.0	89.8 (-0.5)
	Convexity(°)	4.2 ± 2.1	0.3 (-1.9)	4.1 ± 2.1	2.6 (-0.7)
	Facial depth(°)	84.5 ± 2.5	90.7 (2.5)	84.7 ± 2.5	86.3 (0.6)
	Mc A(mm)	1.0 ± 2.0	0.9 (-0.1)	1.0 ± 2.0	-0.1 (-0.6)
	Mc Pog(mm)	-6.1 ± 2.0	1.0 (3.5)	-5.7 ± 2.0	-5.2 (0.2)
	Facial axis(°)	85.5 ± 3.0	89.3 (1.3)	85.5 ± 3.0	86.5 (0.3)
	LFH(°)	48.2 ± 3.5	43.7 (-1.3)	48.2 ± 3.5	43.9 (-1.2)
Dental measures	Overjet(mm)	3.2 ± 2.0	-2.0 (-2.6)	3.2 ± 2.0	4.0 (0.4)
	Overbite(mm)	2.3 ± 2.0	3.5 (0.6)	2.3 ± 2.0	3.0 (0.4)
	U1 to APo(mm)	7.0 ± 2.0	0.9 (-3.1)	7.0 ± 2.0	3.3 (-1.9)
	U1 to APo(degree)	27.0 ± 5.0	21.7 (-1.1)	27.0 ± 5.0	26.8 (0.0)
	L1 to APo(mm)	4.4 ± 1.6	4.0 (-0.3)	4.4 ± 1.6	-0.4 (-3.0)
	L1 to APo(degree)	26.0 ± 5.0	29.6 (0.7)	26.0 ± 5.0	18.0 (-1.6)
Soft tissue measures	Nasolabial angle(°)	93.5 ± 10.5	80.6 (-1.2)	122.0 ± 4.2	135.2 (3.1)
	UL to E.plane(mm)	-0.5 ± 2.0	1.7 (1.1)	-0.5 ± 2.0	5.8 (3.2)
	LL to E.plane(mm)	3.0 ± 1.7	2.5 (-0.3)	3.0 ± 1.7	0.3 (-1.6)

Table 1. pre and post ceph analysis

◆ Regarding the eruption of the maxillary canines and premolars, periodic examinations are still necessary, and orthodontic treatment including an additional 2*4 appliance is currently in progress.

Case 2

Patient information

Age/Sex : 7Y 11M / M

PMH : secundum atrial septal defect, duodenal atresia

CC : loosening of lower incisor due to trauma

◆ Problem list
- Skeletal class III
- Anterior crossbite
- Traumatic occlusion(#31,41), mobility(+)
- Abnormal eruption pathway of #15

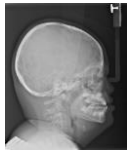

Fig 6. pre-treatment cephalometric

Orthodontic treatment

◆ Four months after orthodontic analysis, when the patient was ready to receive orthodontic treatment, bonded RPE with vestibular hook was delivered. Activation was performed twice a week, and once a week after 4 months of RPE delivered. 11 months after starting facemask, appropriate maxillary traction was obtained. Debonding of RPE was performed.

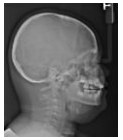

Fig 8. post-treatment cephalometric

		Pre-treatment		Post-treatment	
		Mean ± SD	Patient(Deviation)	Mean ± SD	Patient(Deviation)
Skeletal measures	SNA(°)	81.0 ± 2.7	83.5 (0.9)	81.0 ± 2.7	85.0 (1.5)
	SNB(°)	78.5 ± 2.7	84.1 (2.1)	78.5 ± 2.7	82.3 (1.4)
	ANB(°)	2.5 ± 2.0	-0.6 (-1.6)	2.5 ± 2.0	2.7 (0.1)
	Wits appraisal(mm)	-2.0 ± 2	-8.7 (-3.4)	-2.0 ± 2.0	-2.8 (-0.4)
	Maxillary depth(°)	91.3 ± 3.0	94.1 (0.9)	91.3 ± 3.0	92.8 (0.5)
	Convexity(°)	4.4 ±2.1	-1.0 (-2.6)	4.1 ± 2.1	1.2 (-1.4)
	Facial depth(°)	84.1 ±2.5	95.5 (4.5)	84.6 ± 2.5	91.3 (2.7)
	Mc A(mm)	1.0 ± 2.0	3.1 (1.0)	1.0 ± 2.0	2.2 (0.6)
	Mc Pog(mm)	-6.5 ± 2.0	7.9 (7.2)	-5.79 ± 2	1.9 (3.8)
	Facial axis(°)	85.5 ± 3.0	99.3 (4.6)	85.5 ± 3.0	101.9 (5.5)
	LFH(°)	48.2 ± 3.5	39.1 (-2.6)	48.2 ± 3.5	35.9 (-3.5)
Dental measures	Overjet(mm)	3.2 ± 2.0	-1.5 (-2.4)	3.2 ± 2.0	4.0 (0.4)
	Overbite(mm)	2.3 ± 2.0	2.5 (0.1)	2.3 ± 2.0	2.0 (-0.2)
	U1 to APo(mm)	7.0 ± 2.0	2.7 (-2.1)	7.0 ± 2.0	6.4 (-0.3)
	U1 to APo(degree)	27.0 ± 5.0	22.2 (-1.0)	27.0 ± 5.0	36.4 (1.9)
	L1 to APo(mm)	4.4 ± 1.6	4.3 (0.0)	4.4 ± 1.6	0.7 (-2.3)
	L1 to APo(degree)	26.0 ± 5.0	32.3 (1.3)	26.0 ± 5.0	24.9 (-0.2)
Soft tissue measures	Nasolabial angle(°)	93.5 ± 10.5	99.5 (0.6)	93.5 ± 10.5	84.2 (-0.9)
	UL to E.plane(mm)	-0.5 ± 2.0	-1.3 (-0.4)	-0.5 ± 2.0	0.2 (0.4)
	LL to E.plane(mm)	3.0 ± 1.7	3.6 (0.4)	3.0 ± 1.7	1.7 (-0.7)

Table 2. pre and post ceph analysis

◆ Routine check-ups are necessary in relation to the eruption of the left and right maxillary canines and premolars. Recently, early extraction of the maxillary left primary canine was performed for the eruption of the maxillary left canine.

Summary

Patients with Down syndrome may have delayed development and have a high risk of periodontal disease. Therefore, it is difficult to perform orthodontic treatment without proper cooperation and oral hygiene management. However, because the difference varies greatly depending on the patient, orthodontic treatment may be performed for some patients. The use of RPE and FM for skeletal class III Down syndrome patients can improve the midface deficiency, restore functional and aesthetic function, and increase the quality of life of patients. In both cases, the maxillary-mandibular relationship seemed to be significantly improved, overjet increased and crossbite was resolved. Additionally, the patients with Down syndrome commonly experience symptoms of snoring, heavy breathing, and obstructive sleep apnea due to their skeletal characteristics. Rapid palatal expansion may be a non-invasive treatment option for these symptoms. In particular, in Case 1, the snoring symptoms improved, and the use of RPE for Down syndrome patients appears to be useful not only from dental perspective but also from the perspective of sleep disordered breathing(SBD).