阪大歯学誌　59(2)：91 ～ 96，2015

Treatment of skeletal Class II malocclusion using temporary anchorage devices

A case report

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（平成 26 年 11 月 8 日受付）

Introduction

In patients with a skeletal Class II jaw-base relationship, the selection of camouflage treatment or orthognathic surgery is determined based on the patient's concerns, extent of profile convexity and amount of overjet[1]. The degree of improvement in facial appearance has been reported to be greater after orthognathic surgery than treatment with orthodontic camouflage[2]. Meanwhile, Conley and Jernigan reported that favourable soft tissue changes can be achieved with orthodontic camouflage using premolar extraction[3]. Additionally, almost all Class II patients treated orthodontically with premolar extraction only are satisfied with their treatment outcome[4]. In order to effectively achieve these soft tissue changes and reduce overjet, however, maximum anchorage is essential. Recently, temporary anchorage devices have been applied to reinforce anchorage, exhibiting advantages in overjet reduction compared with that obtained with conventional headgear appliances[5].

This case report describes non-surgical orthodontic treatment using temporary anchorage devices for incisor retraction and intrusion in a patient with skeletal Class II protrusion and an increased overbite.

History

The patient was a 34-year and 5-month-old Japanese female who complained of protrusion of the

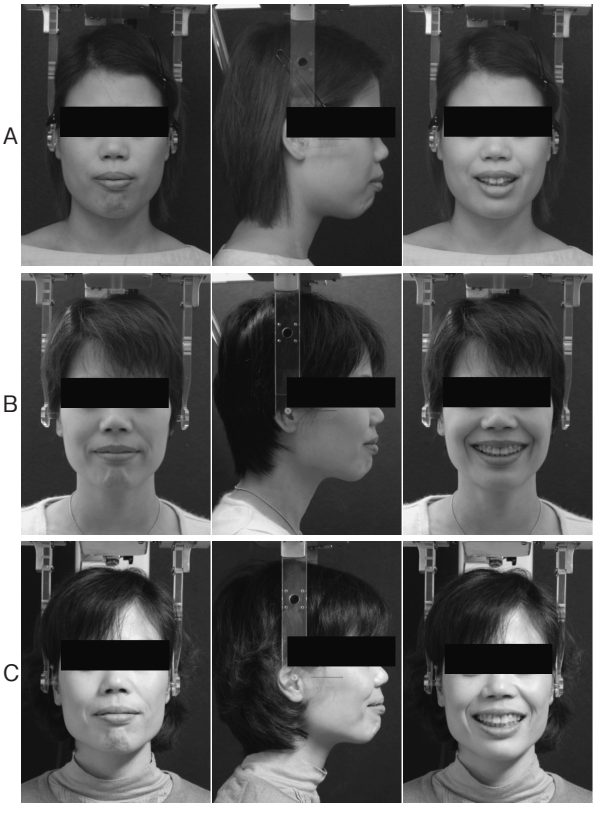

Figure 1. Facial photographs. A: Pre-treatment, B: Post-active treatment, C: Post-retention.

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upper lip. She had a convex type facial profile with an increased lower face height proportion (Fig. 1A). Acceptable facial asymmetry and balance were observed on a frontal examination, and the upper and lower lips were flaccid, exhibiting protrusion relative to Ricketts' E plane[6] and incompetence at rest. In addition, an anterior oral seal was created by lip to lip contact, with a pronounced mentalis muscle activity. However, the nasolabial angle was within the normal limits[7]. There were no signs or symptoms of disorder of the temporomandibular joint.

The patient displayed moderate labial segment crowding, with labially inclined and mesially rotated central incisors on the upper dental arch and mild labial and right lateral segment crowding associated with a distally rotated first premolar on the lower dental arch (Fig. 2A). The arch length discrepancy was -1.5 mm for the maxillary arch and -0.6 mm for the mandibular arch. She showed Angle Class II molar relationships on both sides, with increased overjet (+9 mm) and overbite (+5 mm) (Fig. 3A).The upper and lower dental midline was coincidental with the facial midline.

A panoramic radiograph confirmed all permanent teeth to be present, with no alveolar bone resorption in the maxilla or mandible (Fig. 4A).

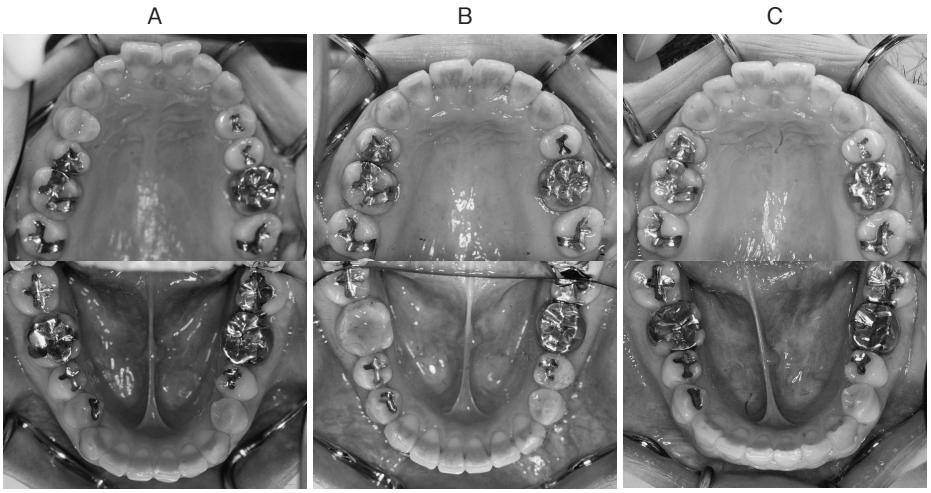

Figure 2. Intraoral photographs (occlusal view). A: Pre-treatment, B: Post-active treatment, C: Post-retention.

Figure 3. Intraoral photographs (frontal and lateral views). A: Pre-treatment, B: Post-active treatment, C: Post-retention.

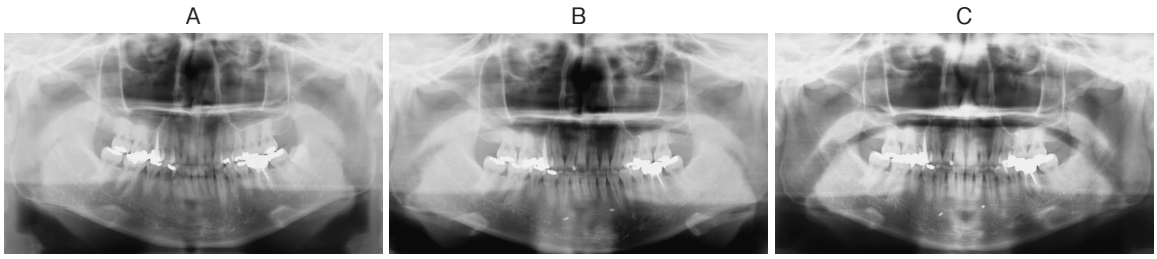

Figure 4. Panoramic radiographs. A: Pre-treatment, B: Post-active treatment, C: Post-retention.

Table 1. Changes in the cephalometric measurements during the orthodontic treatment

Cephalometric Measurements	Pre-treatment	Post-treatment	Post-retention	Normative Mean (SD)
Angular (deg.)				
SNA	87.5	87.5	87.5	80.8 (±3.6)
SNB	80.5	80.5	80.5	77.9 (±4.5)
ANB	7.0	7.0	7.0	2.8 (±2.4)
MM angle	28.0	28.0	28.0	27.9 (±4.1)
U1-PP	114.0	108.5	108.5	115.0 (±7.0)
L1-MP	101.0	104.0	103.5	93.4 (±6.8)
Interincisal Angle	117.0	119.0	119.5	123.6 (10.6)
Linear (mm)				
Lower incisor to Apo line	6.0	4.0	4.0	0-2
Lower lip to Ricketts' E-plane	8.0	4.0	4.0	-2.0
Overjet	9.0	3.0	3.0	3.1 (±1.0)
Overbite	5.0	3.0	3.0	3.3 (±1.9)
Wits appraisal	4.0	4.0	4.0	0
Face height ratio (%)	60.0	60.0	60.0	55

A cephalometric analysis revealed a Class II skeletal relationship with an ANB of 7° and Wits appraisal of 4 mm. The detection of an increased SNA value (87.5°), relative to Japanese norms[8], suggested that the maxilla was placed anteriorly (Table 1).The vertical proportions, as assessed according to the face height ratio (60%), were increased, supporting the clinical findings. The maxillary-mandibular planes angle (28°) was normal, and the upper incisors (114°) were of average inclination in reference to Japanese norms. Meanwhile, the lower incisors (101°) were significantly proclined in relation to racial norms, and the interincisal angle was significantly reduced (117°), considering the proclined lower incisors. Finally, the lower incisor edge was positioned anteriorly relative to the A-pogonion reference line (+6 mm), and the upper and lower lips both significantly protruded relative to Ricketts' E-plane.

DIAGNOSTIC SUMMARY

The patient presented with a Class II division 1 incisor relationship on a Class II skeletal base with increased vertical proportions. The upper and lower lips were flaccid, protrusive and incompetent at rest. The malocclusion was complicated by a 9-mm overjet, moderate upper and lower labial segment crowding and an increased overbite incomplete to the upper central and lateral incisors. The lower incisors were significantly proclined. The dental health component of the Index Of Treatment Need (IOTN)[9] was 5a and the aesthetic component was 9.

PROBLEM LIST

1. Class II skeletal relationship
2. 9-mm overjet
3. Incompetent, protrusive lips
4. Increased overbite
5. Lower incisor proclination
6. Moderate upper and lower labial segment crowding

TREATMENT PLAN

The aims and objectives of the treatment were as follows:

1. Accept the Class II skeletal pattern
2. Relieve the crowding
3. Level, align and coordinate the dental arches
4. Reduce the overjet and achieve competent lips at rest
5. Correct the overbite
6. Retain the corrected results

The treatment was planned as follows: (1) extraction of the upper first premolars, (2) alignment of all teeth with pre-adjusted edgewise fixed appliances (0.022" x 0.028" slot) using the Roth prescription and (3) retention.

A TAD and transpalatal arch to the maxillary first permanent molars were required to reinforce anchorage in the anteroposterior direction. Additionally, a TAD was required in the anterior segment in order to intrude the upper and lower incisors.

Treatment progress

Following extraction of the upper first premolars, fixed appliances were placed in both arches. TADs were placed nearby the root of the upper and lower incisors and upper molars. A transpalatal arch was fitted for anchorage reinforcement. After initial levelling and alignment, the upper and lower incisors were intruded using TADs. Rectangular 0.019×0.025-in stainless steel archwires were used to close the extraction spaces with sliding mechanics. After 27 months, the treatment was complete, and all appliances and TADs were removed. Upper and lower wraparound retainers were fitted for retention, and the patient was instructed to wear removable retainers full time for the first one year and then at night for the next year only.

Treatment results

A Class II molar relationship and normal overjet and overbite were achieved (Fig. 2B and 3B), and the protrusion of the upper lip was corrected. As a result, a harmonious facial profile was achieved (Fig.1B). A cephalometric analysis (Table 1) revealed that the SNA, SNB and maxillary-mandibular planes angle did not change during the treatment. Meanwhile, the upper incisor to maxillary plane angle decreased by 5.5° to 108.5° following retraction of the upper labial segment, and the lower incisor to mandibular plane angle increased by 3° to 104°, suggesting mild proclination of the lower labial segment with treatment. As a result of these changes, the interincisal angle increased by 2° to 119°. In addition, the lower incisal edge position retreated by 2 mm relative to the A-pogonion reference line. The nasolabial angle increased by 2° and the lower lip position relative to Ricketts' E-plane was reduced by 4mm; both of these changes can be partly explained by the change in the upper incisor position achieved with treatment. Sella-nasion superimposition (Fig. 5A) indicated that the maxillary incisors were retracted, and the facial profile improved. The presence of maxillary superimposition (Fig. 5B) confirmed that the upper incisor was retracted and impacted. Furthermore, there was a small amount of mesial molar movement, implying some anchorage loss, and mandibular superimposition (Fig. 5C) demonstrated that the lower incisor was mildly advanced and with uprighting of the mandibular first molar. The patient's two-year follow-up records showed good stability with no obvious relapse (Fig. 1C, Fig. 2C and Fig. 3C). At the end of the treatment, the dental health component of the IOTN was 2g and the aesthetic component was 1.

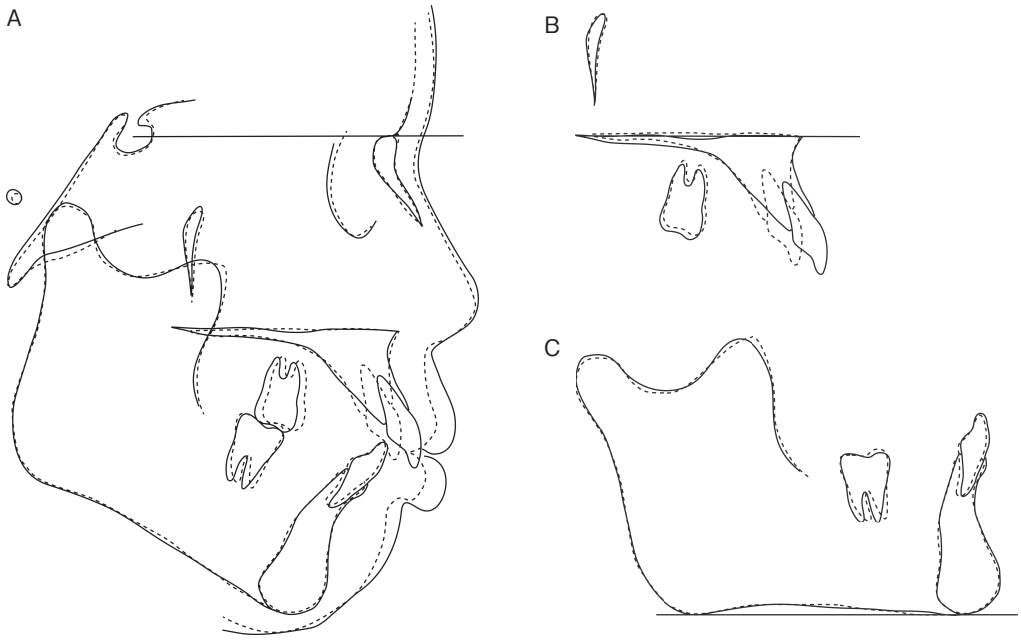

Figure 5. Superimposition of the pre-treatment and post-active treatment lateral cephalometric tracings. A: Superimposed on the SN plane at S; B: Superimposed on the palatal plane at ANS'; C: Superimposed on the mandibular at Me. Solid line: pre-treatment; Dotted line: post-active treatment.

Discussion

Orthognathic surgery was initially considered in this case in order to improve the patient's Class II skeletal relationship. The 9-mm overjet was considered to be within the limits of orthodontic camouflage[1]. Class II camouflage treatment with extraction of the upper premolars and maximum anchorage enables the patient to achieve a favourable change in their facial profile[3]. In addition, the occlusion obtained with camouflage treatment using premolar extraction in Class II cases has been reported to be stable[4]. Therefore, we selected the camouflage treatment plan in this case. First premolar extraction in the maxillary arch was deemed necessary due to the maximum space required to relieve the crowding and reduce the overjet. With respect to the maxilla, there was a high demand for anchorage; notably, the canines required full unit correction, and headgear was initially considered for maxillary anchorage. However, temporary skeletal anchorage is more effective for retracting the upper incisors than a headgear appliance[5]. Accordingly, the anchorage was reinforced with a TAD in the present case.

The mandibular arch was treated on a non-extraction basis because the crowding amounted to less than 1 mm. Considering the stability in deep bite cases, the lower incisors should be retroclined in order to increase the interincisal angle to normal. However, no attempts were made to upright the proclined lower labial segment towards the normal range, the inclination facilitated orthodontic camouflage. The slight proclination of the lower incisors observed in this case was considered to be acceptable.

The 9-mm overjet was successfully reduced to within the normal limits, and the overbite decreased as a result of upper incisor intrusion. In addition, the Roth bracket prescription, with an increased mesial tip in the upper canine, helped to minimise distal inclination of the canine during retraction and promote canine guidance. As a result, the final anterior occlusal fit was good. Posteriorly, finishing to a Class II molar relationship meant that the occlusal fit was slightly compromised. Nonetheless, the degree of buccal segment interdigitation was reasonable and further settling is anticipated.

The favourable soft tissue drape facilitated orthodontic camouflage of the Class II skeletal pattern,

without harming the patient's dentofacial appearance. The lips were competent at the end of treatment, with the upper incisors under the lower lip; these are favourable features for long-term stability of overjet correction[10]. Although camouflage patients have been reported to have slightly greater overjet at one year after treatment compared with patients treated with orthognathic surgery[11], no relevant increase was observed in the overjet during the retention period in this case.

Finally, the current patient was successfully treated with orthodontic camouflage over 27 months. The original treatment aims were accomplished, and the patient's presenting complaint was addressed. She was notably pleased with the treatment outcome, and good occlusal and aesthetic results were obtained, as reflected in the IOTN score.

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