

Treatment of skeletal 2 malocclusion using bone-plate anchorage. A case report

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Objective: To report the treatment of a severe Class II division 1 malocclusion using bone-plate anchorage.

Methods: A 12 year-old Thai girl presented with a skeletal 2, Class II division 1 malocclusion. Following extraction of the maxillary first premolars and mandibular second premolars, the maxillary anterior teeth were retracted and the mandibular posterior teeth moved mesially. A miniplate with screws, placed in each zygomatic buttress, was used as absolute anchorage for coil springs to retract the maxillary anterior six teeth.

Results: After treatment, the patient presented with a normal overjet and overbite, a dental Class I relationship bilaterally and an improved facial profile.

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Introduction

It is generally accepted that a skeletal 2 malocclusion is associated with a large maxilla, a deficient mandible or a combination of these factors. On the other hand, a dental Class II division 1 malocclusion is due to dentoalveolar variation and may result from proclined maxillary anterior teeth. The treatment approaches for a skeletal 2 malocclusion include growth modification, camouflage treatment or combined orthodontic treatment and orthognathic surgery. The choice of treatment will depend on factors such as: the cause(s) of the malocclusion, the site and severity of the discrepancy, the age or growth potential of the patient, the facial aesthetics, psychological factors and financial concerns.¹

Growth modification of a skeletal 2 malocclusion in a growing patient may be achieved with either extra-oral or functional appliances.^{2,3} The treatment possibilities for skeletal 2 malocclusions in non-growing patients may be either by orthodontic tooth movement to camouflage the underlying jaw discrepancy or by surgical repositioning of the jaws.¹ Compared with the surgical method, camouflage treatment is a simpler procedure, has fewer risks and complications, costs less and often results in an improved occlusion with a small change in the facial profile.^{4,5}

Camouflage treatment of a Class II division 1 malocclusion with a large overjet is considered to be one of the most difficult forms of orthodontic treatment because of the difficulty in preventing anchorage loss. The difficulties arise because methods of intra-oral anchorage, such as transpalatal bars or Nance appliances, are not completely stable and, in some circumstances, cannot support the forces used to move the teeth.⁶ Additional extra-oral anchorage in the form of headgear can provide stable anchorage, but this form of anchorage depends on the patient's compliance.^{7–9}

To provide stationary anchorage that will allow orthodontic treatment to proceed rapidly with a predictable result, osseous implants of various materials and designs have been developed.^{10–13} An osseointegrated implant placed in the palate is an effective form of intra-oral orthodontic anchorage for Class II division 1 treatment.¹⁴ A number of other designs of orthodontic implants can be used to provide stationary anchorage for Class II treatment such as: mini-screws,^{12,13,15} miniplates with tube,¹⁶ the zygomatic anchorage system,¹⁷ and microscrews.^{18,19}

Sukawara introduced a skeletal anchorage system (SAS) using bone-plates and screws as orthodontic anchorage.²⁰ Bone-plates fixed with screws can be



Figure 1. Initial study models.

Table 1. The summary of the changes between the pretreatment and posttreatment conditions.

Area consideration		Pretreatment	Post-treatment
Skeleton	Antero-posterior	Skeletal 2	Skeletal 2
	Vertical	Skeletal hyperdivergence	Skeletal hyperdivergence
Dental arch	Alignment	Malaligned, mild crowding, large overjet	Well-aligned, no crowding, normal overjet
	Arch form	Tapered maxillary and mandible arch	Parabolic maxillary and mandible arch
Dental	Canine relation	Class II on both sides	Class I on both sides
	Molar relation	Class II on right side Class I on left side	Class I on both sides
	Overjet	6.5 mm	1.5 mm
	Overbite	3.0 mm	1.5 mm
	Maxillary incisor	Proclined and protruded	Retroclined and retruded
	Mandibular incisor	Proclined and protruded	Normal inclination and position
	Midline	Mandibular dental midline shifted to right 2 mm.	Maxillary and mandibular dental midlines are at the centre line.
	Tooth number	Remained primary maxillary second molars.	Balanced
Soft tissue	Upper lip	Protrusion (moderate)	Protrusion (mild)
	Lower lip	Protrusion (moderate)	Normal position
Face	Frontal	Symmetry	Symmetry
	Profile	Convex	Normal

placed at a safe distance from the roots of teeth, in areas such as the midpalate or zygomatic buttress, where they are easily placed and removed. This type of implant is considered to provide absolute skeletal anchorage for tooth movement.^{21–23} This report will describe the treatment of a severe Class II division 1 malocclusion using bone-plate anchorage.

Case report

A 12 year-old Thai girl with a Class II division 1 malocclusion on a skeletal 2 base and a convex profile was accepted for treatment in the orthodontic department, Khon Kaen University. When she first presented the patient complained of proclined upper anterior teeth. It was felt that the malocclusion and

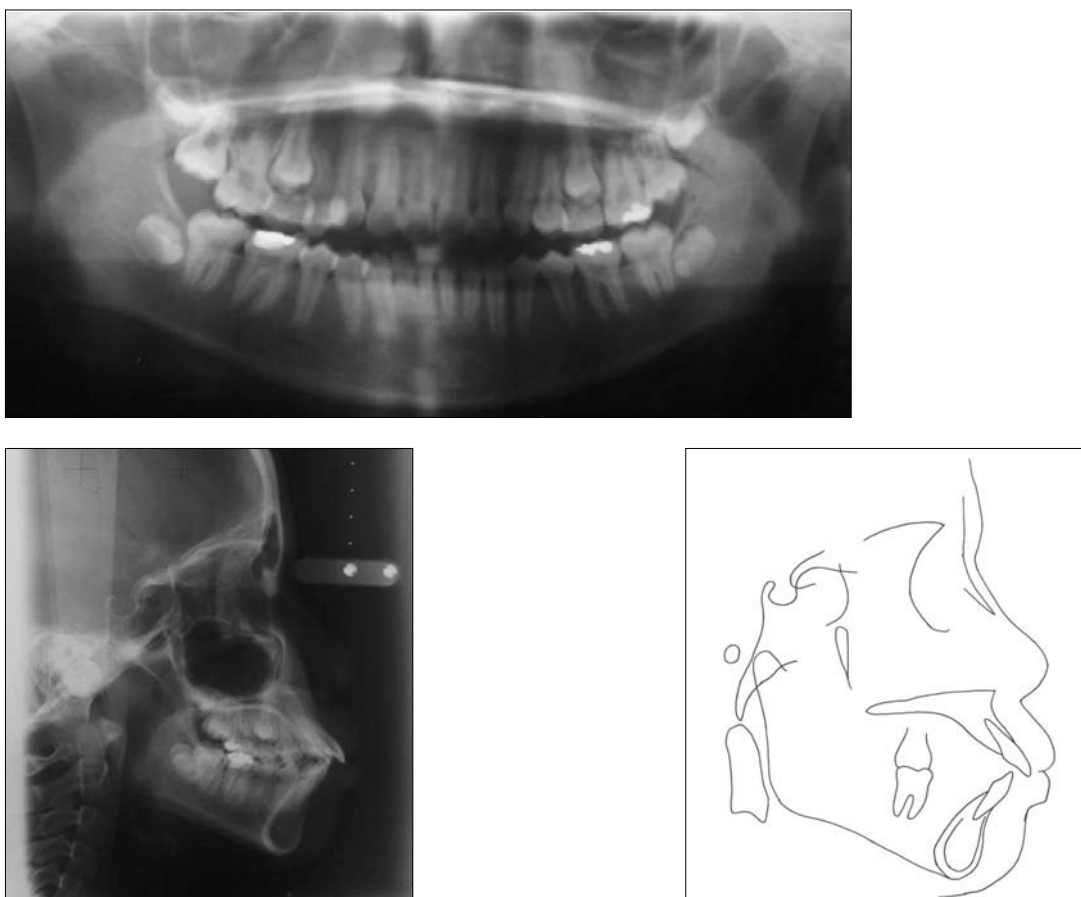


Figure 2. Initial panoramic radiograph and lateral cephalometric radiograph with tracing.

her facial appearance had contributed to her lack of self-confidence. She had good general health and was a sporadic attendee for dental check-ups.

The patient's facial profile was convex, with slightly long lower anterior facial height relative to the upper anterior facial height. She had an acute nasolabial angle and her lips were incompetent at rest and protrusive with slightly everted upper lip. The smile line was normal and 100 per cent of upper incisors were displayed. Her chin lacked prominence and the chin button was on the facial midline.

The patient's main problem was maxillary incisor proclination. She had a late mixed dentition with maxillary second primary molars about to exfoliate. There was a Class II end-on molar occlusion on the right side, Class I molar on the left, and Class II canine relationships on both sides, and an overjet of 6.5 mm. The mandibular incisors were also proclined. She had 3.0 mm of positive overbite.

The upper dental midline coincided with the midsagittal plane, while the lower dental midline deviated 2.0 mm to the right. In a functional evaluation, there were no CR – CO discrepancies and no signs or symptoms of temporomandibular dysfunction.

There was 3 mm crowding in the maxillary anterior segment and 2 mm crowding in the mandibular anterior segment. Bolton's ratios indicated that there was no tooth-size discrepancy. The initial study models are shown in Figure 1.

Radiographic and cephalometric findings

The pretreatment radiographs are shown in Figure 2. The panoramic radiograph showed the late mixed dentition with all teeth present including developing third molars. No significant abnormalities were detected. The cephalometric analysis indicated a skeletal 2 relationship. The maxillary and mandibular

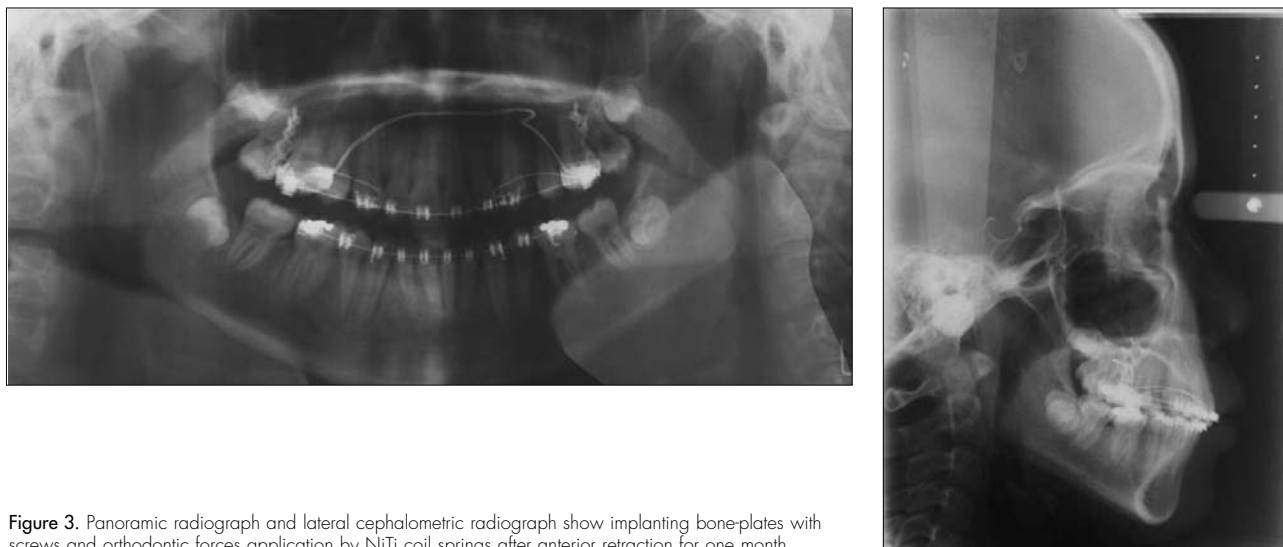


Figure 3. Panoramic radiograph and lateral cephalometric radiograph show implanting bone-plates with screws and orthodontic forces application by NiTi coil springs after anterior retraction for one month.



Figure 4. Facial photograph show slightly improvement in facial profile after anterior retraction for one month.

incisors were proclined and protruded. The upper and lower lips were protrusive. Pretreatment cephalometric findings are summarised in Table I.

Diagnosis

The diagnosis for this case was Class II division I on a skeletal 2 base with a convex profile. The clinical problems were: a skeletal 2 pattern with slightly prognathic maxilla and orthognathic mandible; Class II molar and canine relationships; a convex profile with protrusive lips; severely proclined and protruded

maxillary and mandibular incisors; an overjet of 6.5 mm; the lower dental midline was 2 mm to the right; there was 3 mm crowding in upper arch and 2 mm crowding in lower arch.

Treatment plan

The objectives in treating the malocclusion were to retract the maxillary anterior teeth, to achieve a normal overjet and overbite, to obtain a Class I canine relationship, and to move the mandibular posterior teeth forwards into Class I occlusion and to improve the facial and lip profiles. The initial treatment plan involved extraction of both maxillary first premolars and both mandibular second premolars and use of a transpalatal bar and headgear for control of anchorage.

Treatment

Both arches were banded and bonded with 0.022 × 0.028 inch preadjusted fixed appliances for initial leveling and aligning on 0.014 inch, 0.016 inch, and 0.018 inch stainless steel arch wires successively. To relieve the anterior protrusion the upper canines were retracted on a 0.016 × 0.022 inch stainless steel arch-wire by power chain between the canines and first molars. During treatment it became apparent that the transpalatal bar and headgear were not going to provide sufficient anchorage to complete treatment. After re-evaluation, the decision was taken to use bone-plates with screws as absolute anchorage to

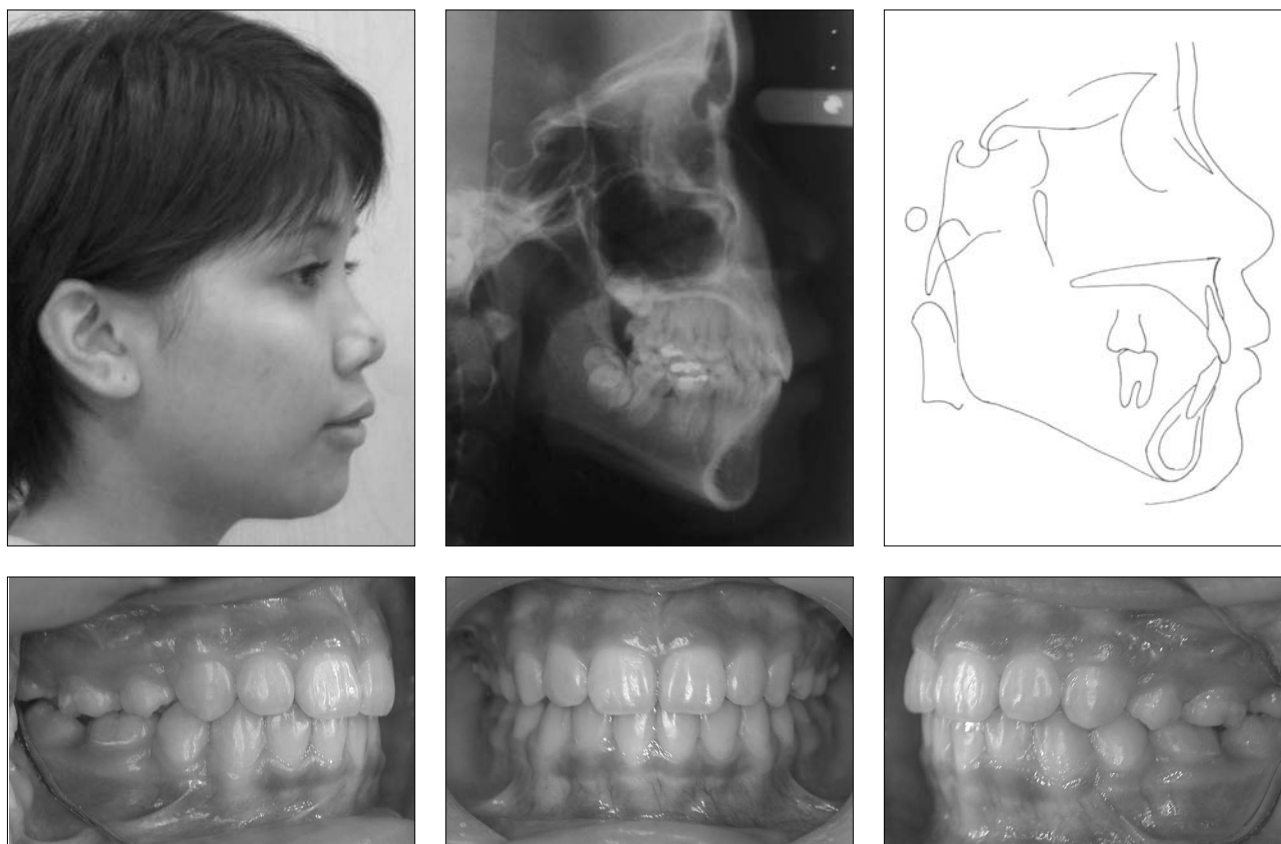


Figure 5. Final facial photograph, lateral cephalometric radiograph with tracing, and intra-oral photographs show improvement in facial profile and dental relationship.

support coil springs to retract the maxillary anterior teeth.

Bone-plates and screws were placed at the inferior borders of the zygomatico-maxillary buttresses. A 0.019×0.025 inch stainless steel arch wire was inserted and nickel titanium (NiTi) closed coil springs with a force of 200 g were applied between the maxillary implants and the hooks on the canine brackets (Figure 3). Slight improvement in facial profile after one month is shown in Figure 4.

Some inflammation and infection occurred around the implants because they were placed too high in the vestibule. The infection was relieved by systemic antibiotic medication and oral hygiene instruction. Most profile change occurred during the first 10 months of treatment using the bone-plate anchorage. The results after two years and two months treatment are shown in Figure 5. There was a marked improvement in the patient's profile and the occlusion. 'Wrap-around' retainers were used in both arches for retention.

The pre- and post-treatment cephalometric superimpositions on the S-N plane are shown in Figure 6. During treatment the maxilla moved forward and the mandible moved downward. In addition, upper and lower lips moved backward and soft tissue chin downward, all leading to a significantly improved facial profile. Superimposition on the best fit of maxilla and on stable structures of the mandible revealed that the maxillary anterior teeth had tipped palatally, the mandibular anterior teeth had tipped lingually and the mandibular molars moved 3 mm mesially into a Class I molar relationship. The pre- and post-treatment cephalometric changes are summarised in Table I.

Discussion

A Class II division 1 malocclusion on a skeletal 2 base is of special interest in orthodontics. There are several different ways of correcting this malocclusion and each depends on a number of factors. As a starting point, the envelope of discrepancy should be

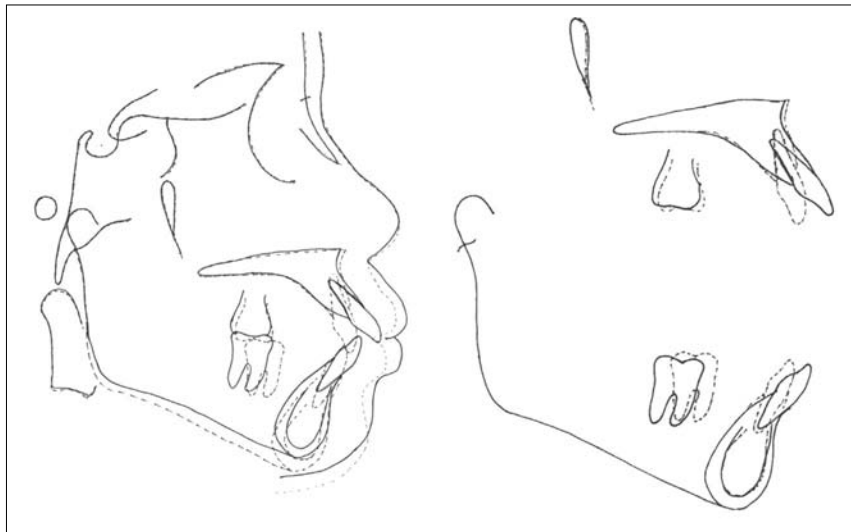


Figure 6. Cephalometric superimposition pretreatment (solid line) and post-treatment (dotted line).

considered to decide if the deformity can be treated by orthodontics alone or by combined orthodontics and orthognathic surgery.¹ For a patient whose discrepancy falls at the edge of the envelope, factors to be considered are: the aesthetic impact of treatment, the patient's preferences, the cost of treatment, likely complications, the length of treatment time and the mechanics that can be used.

In the majority of cases it may be possible to achieve acceptable results by orthodontic treatment alone, but this patient had a severe maxillary protrusion and anchorage loss that required skeletal anchorage to complete treatment. It was not a case of converting to surgical correction. Apart from providing stationary anchorage, implants may simplify the treatment mechanics, enable entire quadrants rather than individual teeth to be moved, and reduce the duration of treatment.²⁴ In this case, the skeletal anchorage system (SAS) using surgical miniplates was chosen because the plates can be placed in safe sites. While the surgical procedure to place the SAS is more extensive than that used to insert microscREW implants, the SAS can support higher forces than those employed with microscREWS.^{19–22}

A NiTi coil spring was selected for force application because it offered a continuous, controlled force. The most outstanding results were the large retraction of maxillary anterior teeth without mesial movement of maxillary posterior teeth, which are the anchor

units in conventional orthodontic treatment. However, it must be noted that the improvement in the overjet was due to retroclination of the maxillary incisors. In retrospect, more attention could have been paid to bodily retraction of the incisors. The fact that this did not happen is attributed to the significant play between the 0.022 inch pre-adjusted bracket slots and the 0.019 × 0.025 inch finishing arches. Maintaining the position of the maxillary incisors will depend not only on the wraparound retainer, but also on an altered lower lip posture.

The mild mucosal inflammation around the screw was traced to irritation from the ligature wire between the implants and NiTi springs. To prevent any inflammation in this area the patient should be instructed to keep the area around the implants clean with meticulous oral hygiene.¹⁶ In the present case, systemic antibiotics were used to deal with the local infection that occurred around the implants and not continued as a prophylactic measure.

Conclusion

The skeletal anchorage system provides stationary anchorage that, under normal circumstances, will allow the anterior teeth to be retracted bodily. In this case, conventional intra-oral anchorage provided by a transpalatal bar and extra-oral traction proved unreliable, with the result that anchorage was lost and the treatment could not be completed without

further extractions or surgery. However, maximum retraction of maxillary anterior teeth and improvement in the facial profile were achieved without further loss of anchorage with the bone-plates and screws as anchorage.

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