

CDABO CASE REPORT

Orthodontic correction of a Class III malocclusion in an adolescent patient with a bonded RPE and protraction face mask

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A case report of a 14-year-old Hispanic male with a Class III skeletal profile and dental malocclusion with a long mandibular body and ramus and retrusive maxilla. The patient was initially referred for a surgical evaluation for a LeFort I maxillary advancement, but he wanted to avoid surgery. The Class III malocclusion was corrected with a bonded rapid palatal expander and a maxillary protraction mask followed by nonextraction orthodontic treatment. A Class I molar and canine relationship was achieved, and the facial profile improved. This case report demonstrates the orthodontic correction of a Class III malocclusion in an adolescent patient with a bonded rapid palatal expander and protraction face mask. This case was presented to American Board of Orthodontics as partial fulfillment of the requirements for the certification process conducted by the Board. (Am J Orthod Dentofacial Orthop 1999;116:177-83)

Class III malocclusion occurs in less than 5% of the US population and is one of the most difficult facial deformities to manage.¹⁻³ Many of the Class III malocclusions are the result of mandibular prognathism; however, some Class III malocclusions are the result of a deficient maxilla, and the treatment plan of choice would be to protract the maxilla downward and forward.⁴⁻⁶ Successful orthopedic correction through growth modification has increased the nonsurgical correction of the growing Class III patient. In addition, maxillary expansion is frequently needed in the treatment of Class III malocclusions to increase the transverse width of the maxilla. According to McNamara⁷ and Turley,⁸ rapid maxillary expansion (RME) may enhance the protraction effect of the face mask by disrupting the maxillary suture system. And it is widely accepted among the orthodontic community that the midface deficient Class III patients should be treated before 7 to 8 years of age.⁹ Recently, Kassisieh¹⁰ has shown that age-related differences in the response to protraction therapy were not significant for maxillary or mandibular horizontal movements. This case report demonstrates the orthodontic correction of a Class III malocclusion in an adolescent patient using a bonded RPE and protraction face mask.

HISTORY AND ETIOLOGY

A 14-year-old-Hispanic male in good physical health presented to the Baylor College of Dentistry orthodontic department with a chief complaint of "my front teeth are crowded and crooked and I want them straight and even." He was 5 feet 10½ inches tall and weighed 141 pounds. His medical history was noncontributory, and he reported no known drug allergies. The patient's mother reported that he had regular dental care. He had occlusal caries in the lower right and left second molars and heavy wear facets and erosion on the occlusal cusps of the lower first molars. The patient had generalized mild gingivitis but no probable depths more than 3 mm. He reported difficulty breathing through his nose and breathes through his mouth frequently. The patient's mother appeared to have similar facial features with maxillary retrusion. The patient appeared to have average motivation, but his mother and father were very interested in his treatment and wanted to try and treat his malocclusion with orthodontics alone and avoid orthognathic surgery.

DIAGNOSIS

Extraoral

The patient presented with a Class III skeletal profile and dental malocclusion with a long mandibular body and ramus and a retrusive maxilla. He had a very straight profile with lips competent and no strain on closing (Fig 1). The maxilla was retrognathic and the mandible was slightly prognathic. He had long facial heights, but they were well proportioned. Incision-stomion was 2.5 mm. The upper midline was coincident with the facial midline, and the lower midline was 1 mm to the left of the upper midline in centric relation (CR). On the basis of his hand/wrist radiograph (Fig 2),

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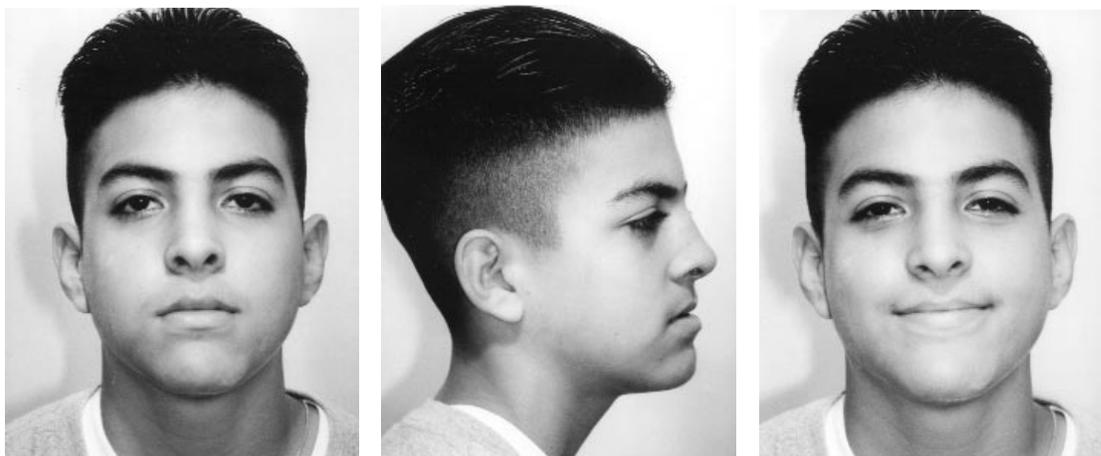


Fig 1. Pretreatment facial photographs.



Fig 2. Hand wrist radiograph pretreatment.

we did not expect that he would demonstrate significant growth.

Intraoral

The patient presented with a Class III dental malocclusion (Fig 3) and a 1 mm overbite in habitual occlusion (CO); he had -2 mm of overjet in CO. The maxillary arch had 5 mm of crowding and mandibular arch had 1 mm of crowding. The mandibular plane angle was within a normal range (Figs 4, 5, and 6). The dentition showed mild compensatory positioning, as the mandibular incisors were retroclined and the maxillary incisors were proclined.

Functional

The patient had good opening and lateral range of movements and reported no limitations or pain in the temporomandibular joints (TMJ). The patient had a 1.5 mm anterior and a 1 mm left CR-CO shift. There were no signs or symptoms of TMJ dysfunction.

Treatment Plan

The patient was initially referred for a surgical evaluation and the option of a Lefort I maxillary advancement was discussed. Because he was extremely motivated about his orthodontic treatment and wanted to avoid orthognathic surgery if at all possible, we agreed to begin a nonsurgical treatment plan in which he would be placed in a bonded rapid palatal expander (RPE) and a maxillary protraction mask. The patient was instructed to wear the protraction face mask as much as possible when he was not in school. Once the RPE was removed, the patient would continue to wear the face mask with elastics worn to the upper arch until the malocclusion was corrected. It was believed that the transverse expansion in the upper arch would provide sufficient space to correct the maxillary crowding. The mandibular arch, with only 1 mm of arch length discrepancy, would be easily corrected with interproximal stripping, so a nonextraction treatment plan was initiated. In addition, Class III elastics would be worn during the day when the protraction mask was not being worn. Lateral and anterior box elastics would be worn as needed. The patient would be placed in a bonded RPE and maxillary protraction mask. The patient would be instructed to wear the protraction face mask for 12 hours or more a day with 16 oz of force, but it was not to be worn to school. The upper anterior teeth and the entire lower arch from second molar to second molar would be

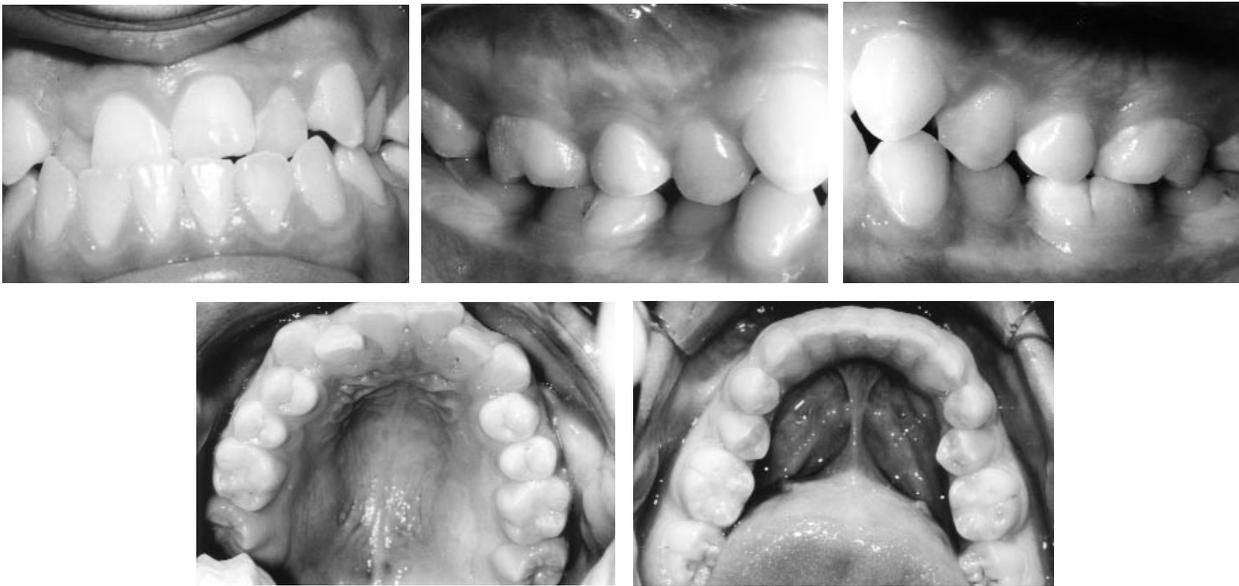


Fig 3. Pretreatment intraoral photographs.

banded and bonded. The RPE would be removed after 5 months and the upper posterior teeth banded and bonded through the second molars. The face mask would continue to be worn to the upper arch until the malocclusion was corrected. Class III elastics would be worn during the day and lateral and anterior box elastics would be worn as needed. The patient would have his appliances removed and placed into a gnathologic positioner as a finishing appliance until final records were taken. The patient would be placed in removable retainers after 3 months of positioner wear.

SPECIFIC OBJECTIVES OF TREATMENT

Maxilla

The objective was to protract the maxilla down and forward and to expand it slightly in the transverse dimension. The forward movement would help to correct the Class III (A-P) dental occlusion. The downward displacement would rotate the mandible downward and forward decreasing its anterior projection and helping to correct the Class III occlusion.

Mandible

The mandible was large but not positioned excessively forward. The goal was to allow for normal mandibular growth. Excessive mandibular growth was not predicted.

Maxillary Dentition

We decided to treat to the mandibular functional and esthetic occlusal plane. This would require extruding the



Fig 4. Pretreatment cephalometric film.

maxillary incisors in order to achieve 2 mm of overbite. The incision-stomion relationship should allow for a 2 mm increase to 4 mm or less if the upper lip grows significantly. It was necessary to treat to the maxillary dental midline because it is also coincident with the $G1'$ -Sn and cupid's bow lip midlines. The premolars were to be expanded because of the dental constriction in this region. The maxillary incisors were to be protracted to help correct the anterior crossbite not accomplished by maxillary protraction. The curve of Spee was to be leveled by maxillary incisor extrusion. The maxillary incisors were to be contoured slightly to help correct uneven wear, with upper incisors potentially requiring contouring with porcelain laminates to correct for abnormal wear and increase the overbite.

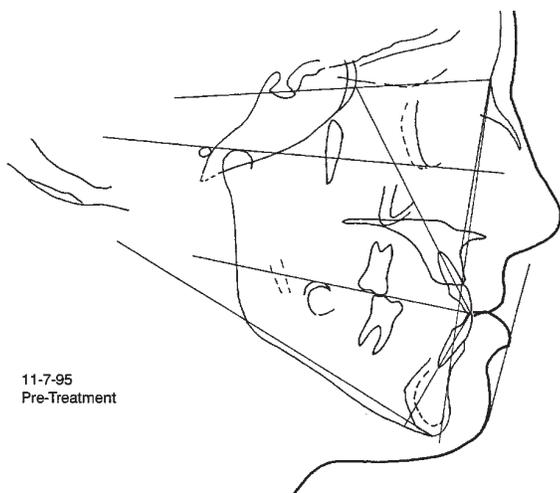


Fig 5. Pretreatment tracing.

Mandibular Dentition

The objective of treatment was to treat to the mandibular functional and esthetic occlusal plane; it was anticipated that a slight widening in the mandibular molar region could occur because of maxillary expansion and because of the lingual inclination of the posterior teeth. The mandibular intercuspid width and the mandibular incisors' position were to be maintained to help compensate for the Class III skeletal relationship.

Occlusion

The occlusal goals were to treat to a Class I canine and molar relationship with 2 mm overbite and 2 mm overjet and to obtain a cuspid protected occlusion with anterior guidance and no balancing interferences.

Facial Esthetics

Protraction of the maxillary arch would increase the upper lip protrusion and decrease the nasolabial angle. The facial goal of treatment was to accept a straight to slightly convex profile in order to avoid surgery.

TREATMENT PROGRESS

The patient and his parents were presented with his treatment options. The patient's parents understood that some compromises would have to be accepted if the protraction didn't work and orthognathic surgery was to be avoided. They were also informed that unfavorable growth of the jaws during or after treatment might necessitate a surgical treatment plan. A bonded maxillary RPE was placed and the expansion screw turned 1 time a day for 20 days. A maxillary protraction face mask was worn to RPE for as many hours a day as the patient could without wearing it to school. Sixteen ounces of force per



Fig 6. Pretreatment panoramic x-ray film.

side was applied by the face mask. While the RPE was in place, the upper anterior teeth were bonded and a buccal tube on the RPE was used to level and align these teeth. The maxillary anteriors were advanced slightly to get them out of crossbite, whereas the RPE provided a bite plane. The lower arch was banded and bonded with a 0.022 twin bracket with Roth prescription from second molar to second molar and 16 × 22 bioforce arch wire (AW) placed. After 5 months, the RPE was removed, and the upper arch was banded and bonded second molar to second molar. A 19 × 25 35° copper, nickel, titanium AW was placed. After 2 months, 19 × 25 stainless steel tied back arch wires were placed in the upper and lower arches. Short Class III elastics were worn when the face mask was not being worn. The face mask elastics were worn to the upper canines with the 19 × 25 SS arch wires tied back. Lateral and anterior box elastics were worn for 2 months. All appliances were removed, and the patient was placed in a gnathologic positioner. The patient wore the positioner 4 hours per day and at night. Occlusal equilibration was performed, and the final records were taken 2 weeks later. Removable retainers will be made for the patient after he has worn the positioner for 3 months.

RESULTS ACHIEVED

Maxilla

The maxilla grew in a downward and forward direction. "A" point was expected to come forward 1 mm in the 1 year 4 month long treatment period for a Class I patient. In untreated Class III maxillary deficient patients, some researchers have found that A point came forward only 0.2 mm over a 6 month period.¹¹ In this patient, a 1.5 mm advancement in A point was achieved. This was due to a combination of maxillary protraction, normal growth, and upper incisor protraction and eruption. The maxilla descended about 1.5 mm, which was due to maxillary protraction, RPE, and normal growth. The maxilla was expanded slightly by RPE.



Fig 7. Posttreatment intraoral photographs.

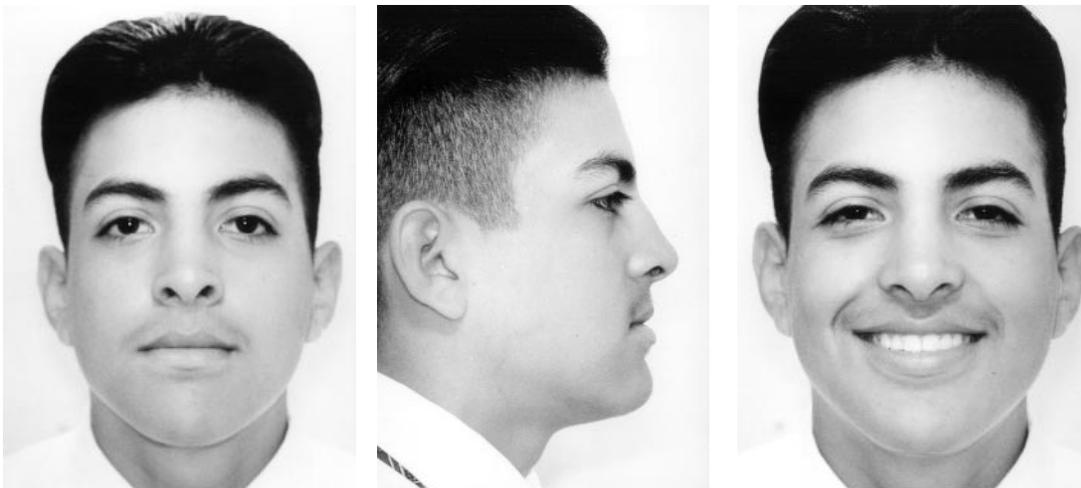


Fig 8. Posttreatment facial photographs.

Mandible

Growth occurred as expected for the mandible. There was good condylar growth; however, the eruption of the lower dentition and the downward movement of the maxilla helped to prevent the forward rotation and forward projection of pogonion and B point.

Maxillary Dentition

Downward movement of the maxilla provided about 1.5 mm of incisor movement downward and forward. The incisors were extruded another 3.5 mm. The molars came down with the maxilla about 1 mm, but they were held from their normal eruption downward from the intrusive force of the occlusion on the bonded RPE and

the intrusive force transmitted from extrusion of the incisors. The molars were expanded slightly, and the buccal root torque improved significantly with the exception of the upper left second molar, which needs more buccal root torque. The second order root positioning and paralleling appeared good. Mild root resorption was apparent in the upper incisors. The gingival heights of the incisors were good, but the excessive wear of the incisal edges indicated that porcelain laminates might be appropriate to contour and lengthen the incisors.

Mandibular Dentition

The lower incisors were retracted very slightly, the lower molars were uprighted buccally, and the second



Fig 9. Posttreatment cephalometric film.

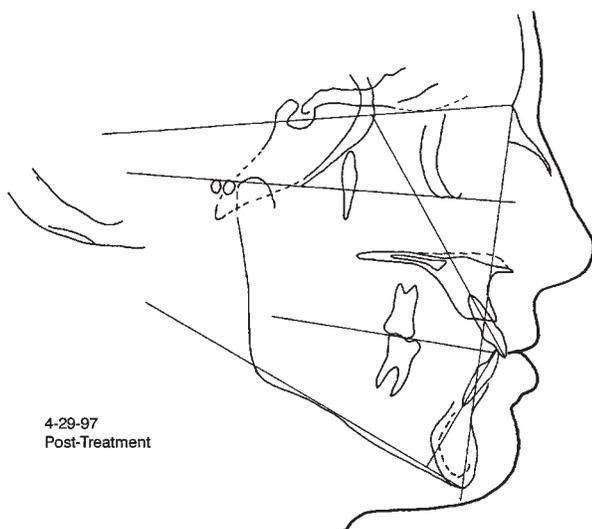


Fig 10. Posttreatment tracing.

premolars were uprighted and expanded. The second order root positioning was good. The intercanine width was expanded only 0.5 mm. The third order positioning of the posterior teeth was improved significantly except for the lower right second molar, which needs more lingual root torque. A slight curve of Spee is present. The lower marginal ridge of first molars are slightly higher than ideal because the cuspal erosion necessitated slightly more extrusion in order to obtain a good occlusion with the upper dentition.

Occlusion

A super Class I molar and Class I canine relationship was achieved (Fig 7). The overbite was 1 mm and the overjet was 2 mm. Canine disclusion and anterior guidance were achieved. The upper incisors were left slightly

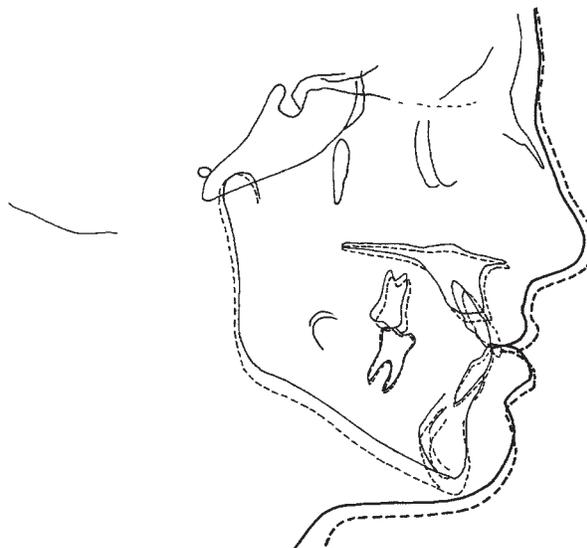


Fig 11. Composite tracing pretreatment and posttreatment.



Fig 12. Composite tracing pretreatment and posttreatment.

flared and the lower incisors left slightly retroclined to help compensate for the skeletal discrepancy.

Facial Esthetics

The facial profile improved (Fig 8). The nasolabial angle became more acute. The upper lip and nose came forward in relation to the chin. A-N-B, A-B/OP, maxillary depth, and facial convexity (N-A-PG) all increased whereas N-Pg/FH and anterior projection of the chin stayed the same (Figs 9-13). Although the maxilla still appears slightly retrognathic, the profile looks more pleasing than before treatment, and maxillary incisor display on smiling is good.

Retention

The patient wore his positioner for 3 weeks when final records were taken. The positioner will be worn for another 3 months and then the patient will be evaluated for a maxillary wrap-around Hawley retainer and a removable lower Hawley retainer.

Final Evaluation

The patient showed a significant improvement in dental appearance and a moderate improvement in facial esthetics. The improvement was the result of the maxilla and maxillary dentition moving downward and forward with the protraction and the downward movement of the mandible, resulting in the anterior projection of the chin remaining essentially the same as before treatment. The cephalometric summary is included in Fig 14. Without surgery, the facial esthetics were improved as much as or better than could be expected. Because there is no family history of prognathism, and the patient presented with a retrognathic maxilla, the possibility of a stable result is good. However, the patient was advised that the maxilla may not continue to grow at the same rate as the mandible and that the occlusion may return to a Class III relationship. The treatment results could be improved with an increased overbite, a flattened upper curve of Spee, and improved third order of the upper left second molar and lower right second molar. Wear of the positioner may improve some of these problems because they were corrected in the set-up. The upper incisors should be restored with laminates to lengthen and restore the worn incisal edges, giving them better incisal contour and increased guidance. The patient and his parents were very pleased with the result of his orthodontic treatment.

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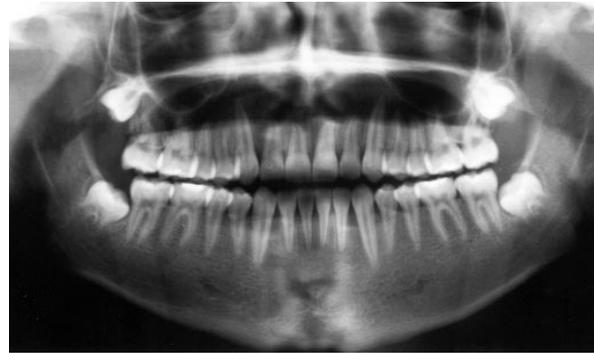


Fig 13. Posttreatment panoramic x-ray film.

	A	B	C	D
	Cephalometric area of study	Candidate's measurements	(A) Pretreatment records (norms)	(B) Post treatment records (norms)
1	Cranial Base	S-N N-S/FH	79.7 mm (68) 8.6 deg (5.3)	80 mm (69) 8.2 deg (6)
2	Maxilla to Cranial Base	S-N-A N-A/FH	77 deg (81) 85.8 deg (90)	78.6 deg (81.8) 86.8 deg (90)
3	Mandible to Cranial Base	S-N-B N-Pg/FH	79 deg (78) 88.5 deg (87)	79 deg (79) 89 deg (87)
4	Maxillo-Mandibular Relationships	A-N-B A-B/OP	-1.6 deg (3.4) -4.7 mm (0)	0 deg (3) -1.3 mm (-0.5)
5	Vertical Relationships	N-Me S-Go N-ANS ANS-Me S-PNS Go-Me/FH	140 mm (118) 89.7 mm (73.5) 60.6 mm (50) 80 mm (62) 55 mm (48) 24.6 deg (23)	144.6 mm (118) 94.4 mm (75) 62 mm (50) 83.4 mm (62) 55.3 mm (49) 24.7 deg (23)
6	Maxillary and Incisor Positions	U1/SN U1/N-A U1(pN-A) L1/N-B L1/Go-Me L1(pGo-Me) U1/L1	114 deg (104) 36 deg (23) 7.5 mm (4) 23 deg (26) 89 deg (96) 48 mm (38) 122 deg (128)	114 deg (104) 36 deg (22) 9 mm (3.5) 22.7 mm (23.3) 89.4 deg (96) 50 mm (37.6) 122 deg (132)
7	Soft Tissue	Nasolabial G1'-Sn-Pg' Incis-Stm LS(pPn-Pg')	116 deg (117) 3.6 deg (6.4) 2.5 mm (2) -9.7 mm (-5.2)	112 deg (113) 8 deg (6.4) 3 mm (2) -7.6 mm (-6)
8	Other	Holdaway ratio N-A-Pg Interincisal width	3:1 -5.7 deg (2.6) 29 mm	3:2 -3.5 deg (2.6) 29.5 mm
9				

Fig 14. Cephalometric summary.

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