

How would you treat this malocclusion?

Pretreatment

Case B.N., 12 years, 3 months

A video of this case can be found at www.pcsortho.org/case-reports/

Diagnosis and Etiology

B.N. presented at the age of 12 years, 3 months with a chief complaint regarding the protrusion of his maxillary central incisors.

Extraoral and Intraoral Findings

The patient has a brachycephalic facial type and slight mandibular asymmetry, with his chin deviating toward his right side. He has a convex facial profile, an acute nasolabial angle, slightly protrusive but competent upper and lower lips, deep labiomental fold, and average chin and nose projections (Figure 1).

Intraorally, he has bilateral end-on Class II molar and canine relationships, bilateral anterior crossbites at maxillary lateral incisors, minimal (0.2 mm) overbite, and a 2-mm functional shift. There is severe dental crowding (7 mm) in the maxilla and moderate spacing (4 mm) in the mandible, with blocked-out maxillary lateral incisors (Figures 1 and 2). The patient's Bolton analysis revealed maxillary excess/mandibular deficiency. The anterior-vertical functional shift of 2 mm was recognized during the clinical examination of the patient, and a functional shift must be assumed whenever a crossbite is present, either anterior or posterior, until the functional shift has been ruled out.

Radiographic Findings

The panoramic radiograph and lateral cephalogram were generated from the pretreatment cone-beam computed tomography scan. The panoramic radiograph indicates that maxillary and mandibular third molars are present, the sinuses appear within normal limits, and the



Figure 1. Pretreatment intraoral and extraoral photographs (B.N., 12 years, 3 months)

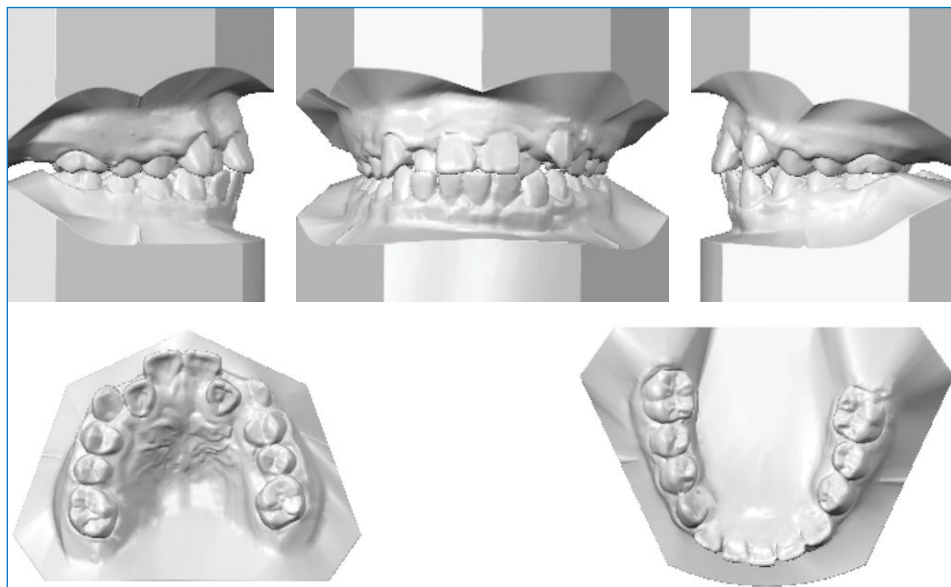


Figure 2. Pretreatment digital models (B.N., 12 years, 3 months)



Figure 3. Pretreatment panoramic radiograph and lateral cephalogram (B.N., 12 years, 3 months)

Table 1. Pretreatment cephalometric measurements

Cephalometric Measurement	Normal Value	Pretreatment Value
SNA (°)	82.0	77.9
SNB (°)	80.0	76.7
ANB (°)	2.0	1.2
FMA (FH-MP) (°)	25.0	23.7
SN-MP (°)	32.0	33.7
U1-NA (mm)	4.0	7.7
U1-SN (°)	104.0	113.3
L1-NB (mm)	4.0	7.0
IMPA (L1-MP) (°)	90.0	109.7
Upper Lip to E Line (mm)	-4.0	1.2
Low Lip to E Line (mm)	-2.0	3.2

condyles are within normal limits with no beaking and adequate cortication. The cephalometric analysis indicates a skeletal Class I pattern (ANB = 1.2°) and a normodivergent growth pattern (SN-MP = 33.7°). The maxillary and mandibular incisors are proclined (U1-SN = 113.3°,

EXAM YEAR _____ ABO DISCREPANCY INDEX
 ABO ID # _____ CASE# _____ PATIENT B.N. _____

TOTAL D.I. SCORE 25

*For mm measures, round up to the next full mm.
 Examiners will verify measurements in each category.*

OVERJET
 ≥ 0 to < 1 mm (edge-to-edge) = 1 pt
 ≥ 1 to ≤ 3 mm = 0 pts
 > 3 to ≤ 5 mm = 2 pts
 > 5 to ≤ 7 mm = 3 pts
 > 7 to ≤ 9 mm = 4 pts
 > 9 mm = 5 pts
 Negative Overjet (x-bite):
 1 pt per mm per tooth = 4 pts
 Total 4

OVERBITE
 > 1 to ≤ 3 mm = 0 pts
 > 3 to ≤ 5 mm = 2 pts
 > 5 to ≤ 7 mm = 3 pts
 Impinging (100%) = 5 pts
 Total 0

ANTERIOR OPEN BITE
 0 mm (edge-to-edge), 1 pt per tooth
 then 1 pt per mm per tooth = 0 pts
 Total 0

LATERAL OPEN BITE
 ≥ 0.5 mm, 2 pts per mm per tooth
 Total 0

CROWDING (only one arch)
 ≥ 0 to ≤ 1 mm = 0 pts
 > 1 to ≤ 3 mm = 1 pt
 > 3 to ≤ 5 mm = 2 pts
 > 5 to ≤ 7 mm = 4 pts
 > 7 mm = 7 pts
 Total 4

OCCUSAL RELATIONSHIP
 Class I to End On = 0 pts
 End-to-End Class II or III = 2 pts per side 4 pts
 Full Class II or III = 4 pts per side 4 pts
 Beyond Class II or III = 1 pt per mm additional 0 pts
 Total 4

LINGUAL POSTERIOR X-BITE
 > 0 mm, 1 pt per tooth Total 0

BUCCAL POSTERIOR X-BITE
 > 0 mm, 2 pts per tooth Total 0

CEPHALOMETRICS (See Instructions)
 ANB ≥ 6° or ≤ -2° @4pts = ____
 Each full degree > 6° x 1 pt = ____
 Each full degree < -2° x 1 pt = ____

SN-MP
 ≥ 38° @2pts = ____
 Each full degree > 38° x 2 pts = ____
 ≤ 26° @1pt = ____
 Each full degree < 26° x 1 pt = ____

I to MP ≥ 99° @1pt = 1
Each full degree > 99° x 1 pt = 10
 Total 11

OTHER (See Instructions)
 Supernumerary teeth x 1 pt = ____
 Ankylosis of permanent teeth x 2 pts = ____
 Anomalous morphology x 2 pts = ____
 Impaction (except 3rd molars) x 2 pts = ____
 Midline discrepancy (≥ 3 mm) @ 2 pts = ____
 Missing teeth (except 3rd molars) x 1 pt = ____
 Missing teeth, congenital x 2 pts = ____
 Spacing (4 or more, per arch) 1 x 2 pts = 2
 Spacing (mx cent diastema ≥ 2 mm) @ 2 pts = ____
 Tooth transposition x 2 pts = ____
 Skeletal asymmetry (nonsurgical tx) @ 3 pts = ____
 Addl. treatment complexities x 2 pts = ____

Identify:

Total Other 2

Figure 4. ABO Discrepancy Index score

IMPA = 109.7°). Both upper and lower lips are protrusive to the E-line, 1.2 and 3.2 mm, respectively (Figure 3 and Table 1). The ABO Discrepancy Index Score for this case is 25 (Figure 4).

How would you treat this malocclusion?

Posttreatment

Case B.N., 14 years, 6 months

Treatment Objectives

Treatment objectives for this case involved the following.

- Correct the functional shift.
- Make space for U2s to alleviate maxillary crowding, advance them into the maxillary arch, and correct the crossbite.
- Close the mandibular spaces.
- Attain ideal inclination of maxillary and mandibular teeth, establish Class I canine relationship, attain ideal overbite and overjet, and coincide the upper and lower midlines.
- Improve incisal display, maintain lip competence, form a consonant smile arc, and improve overall facial harmony.

Treatment Alternatives

Overall, six treatment plans were prepared and presented to the patient and family. The first treatment option was no treatment. The second option involved extraction of the maxillary first premolars (U4s), leveling and aligning, eliminating the functional shift, and developing a therapeutic diagnosis of the mandibular asymmetry in 6 months. The third option was extracting the U4s and mandibular second premolars (L5s) then utilizing maximum anchorage in the upper arch (cervical headgear, Nance appliance, or temporary anchorage device). The fourth option still involved extracting the U4s and performing interproximal reduction (IPR) on the lower 5-5 segment. The fifth treatment plan was utilizing a pendulum appliance for anchorage and distalization of the maxillary first molars (U6s). This option was explained as most likely resulting in unnecessary proclination of the maxillary teeth. The sixth treatment option involved use of a functional appliance (Forsus) or Class II elastics; again, this option was explained as not preferred in this particular case because of the patient's high IMPA (109.7°).

Treatment Plan

The patient and family ultimately elected to move forward with the second treatment option, beginning with extracting the U4s, leveling and aligning, eliminating the functional shift, and developing a therapeutic diagnosis of the mandibular asymmetry in 6 months. Deferment of a therapeutic diagnosis for 6 months allowed us to delay a definitive treatment plan in hopes of reducing the uncertainty related to patient growth at this age. Therapeutic diagnosis allows for better evaluation

of growth response and cooperation with treatment. This therapeutic diagnosis is applicable in children who have skeletal Class II or Class III problems. With this treatment plan, clinicians can utilize the response to the initial treatment to help design a more definitive future treatment plan.

Treatment Progress

Treatment began with bonding the maxillary and mandibular 5-5 and placing separators at maxillary and mandibular 6s for band placement. At this time, a referral was provided to extract the U4s. The initial arch wire used was a 0.014" nickel titanium (NiTi) wire, advancing to a 0.016" NiTi wire after the U4s were extracted. An open coil spring was utilized between the maxillary central incisors and maxillary canines. Leveling and aligning were followed by progressing archwires from 0.014" to 0.016" and 0.020" × 0.020" NiTi wires. These wires were followed by a 0.019" × 0.025" titanium molybdenum alloy wire with a U6-6 power chain. Bracket repositioning was performed at 8 months with a progress panoramic radiograph, and a 0.020" × 0.020" BioForce wire was utilized. The next wire in the sequence was a 0.019" × 0.025" stainless steel wire with a U6-6 power chain, followed by a 0.020" × 0.020" BioForce and 0.019" × 0.025" stainless steel wire. Another panoramic bracket reposition took place after 17 months of treatment, and a 0.020" × 0.020" BioForce wire was used after the repositioning. The final wire sequence progressed from 0.016" NiTi to 0.018" × 0.025" NiTi, 0.018" × 0.025" stainless steel, and 0.018" SS wire with the curve of Spee (Figures 5 and 6). Retention utilized in



Figure 5. One-month progress intraoral photographs (B.N., 12 years, 4 months)

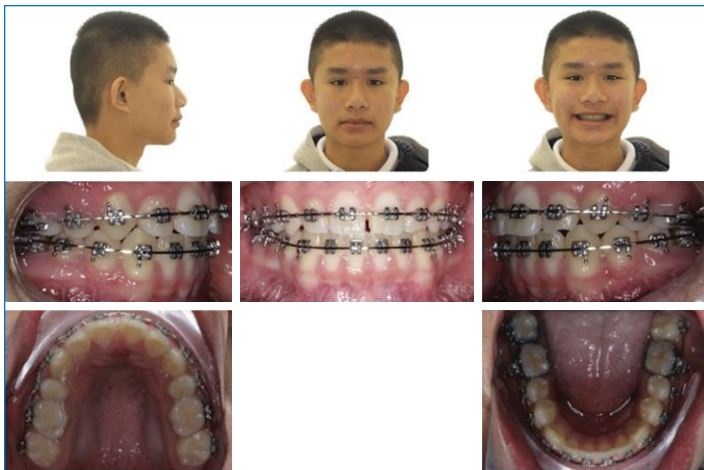


Figure 6. Sixteen-months progress intraoral photographs



Figure 7. Posttreatment facial and intraoral photos (B.N., 14 years, 6 months)

this case was a maxillary Hawley retainer and a mandibular lingual fixed 3-3 retainer.

Treatment Results

Overall, the patient's chief concern was addressed and resulted in a favorable treatment outcome for this patient. The total treatment time was 27 months. Final occlusion resulted in bilateral Class II molar and Class I canine relationships. The anterior crossbite was corrected, and proper upper and lower inclinations were achieved. Final records indicate correction of the functional shift, maxillary crowding, mandibular spacing, and incisal display. An improved smile arc, dental midlines, and overall facial harmony were achieved (Figures 7 and 8).

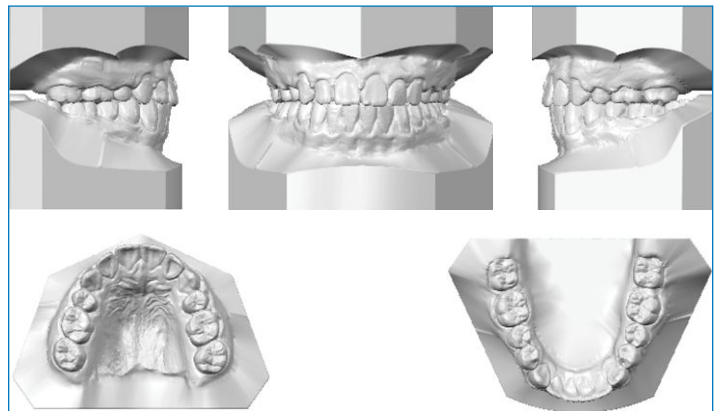


Figure 8. Posttreatment digital models (B.N., 14 years, 6 months)

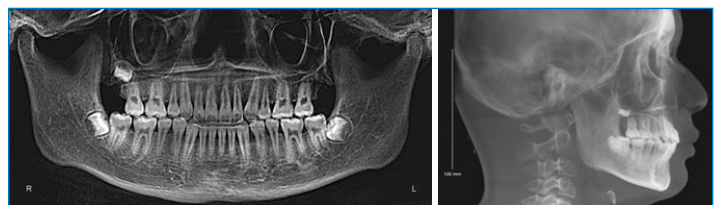


Figure 9. Posttreatment panoramic radiograph (left) and lateral cephalogram (right) (B.N., 14 years, 6 months)

The posttreatment final radiographic records indicated adequate root parallelism, with no signs of root resorption. There were major improvements toward ideal cephalometric measurements seen in U1-SN (113.3° pretreatment, 105.9° posttreatment), U1-NA (7.7 mm pretreatment, 3.3 mm posttreatment), L1-NB (4.0 mm pretreatment, 4.3 mm posttreatment), and IMPA (109.7° pretreatment, 91.5° posttreatment). Improvements were also made to both upper lip to E-line (1.2 mm pretreatment, -0.5 mm posttreatment) and lower lip to E-line (3.2 mm pretreatment, 0.9 mm posttreatment). The upper left third molar was extracted during treatment and did not appear in the posttreatment panoramic radiograph. Slight facial gingival recession was noted on the maxillary right canine compared with the gingival margin of the contralateral left canine.

The notably significant changes to both the maxillary and mandibular incisors can be appreciated by viewing the pretreatment and posttreatment lateral cephalogram and intraoral photographs. The maxillary incisors (U1-SN) were retroclined by a difference of 7.4° and the mandibular incisors (IMPA) were retroclined and uprighed by a difference of 18.2° , as indicated by the cephalogram measurements at the conclusion of treatment. This change is clinically dramatic, considering

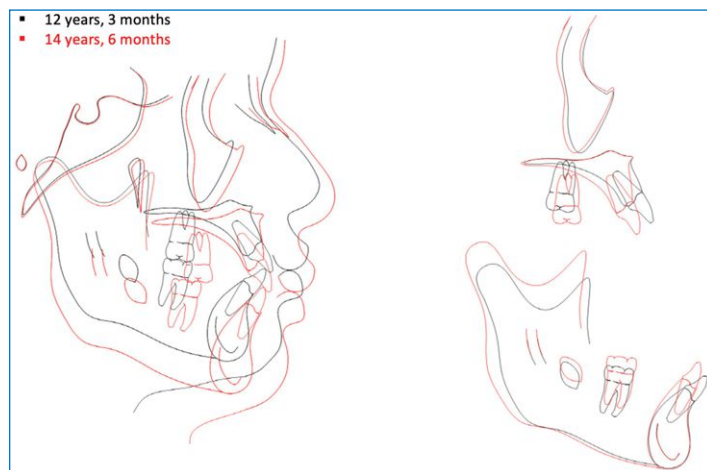


Figure 10. Superimpositions: black, pretreatment; red, posttreatment

Table 2. Comparison of pretreatment and posttreatment cephalometric measurements

Cephalometric Measurement	Normal Value	Pretreatment Value	Posttreatment Value	Difference
SNA (°)	82.0	77.9	80.5	2.6
SNB (°)	80.0	76.7	78.3	1.6
ANB (°)	2.0	1.2	2.2	1.0
FMA (FH-MP) (°)	25.0	23.7	23.8	0.7
SN-MP (°)	32.0	33.7	34.6	0.9
U1-NA (mm)	4.0	7.7	3.3	-4.4
U1-SN (°)	104.0	113.3	105.9	-7.4
L1-NB (mm)	4.0	7.0	4.3	-2.7
IMPA (L1-MP) (°)	90.0	109.7	91.5	-18.2
Upper Lip to E Line (mm)	-4.0	1.2	-0.5	-1.7
Low Lip to E Line (mm)	-2.0	3.2	-0.9	-2.3

that no mandibular extractions were performed. Instead, this result was achieved with IPR. The patient appears to have undergone continued downward and forward mandibular growth during orthodontic treatment, which can be seen by evaluating the superimposition of

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For electronic submission requirement – use ABO Case Report Work File (pdf).

ABO Cast-Radiograph Evaluation
Case # Patient B.N.
Total C-R Eval Score: 20

Alignment/Rotations
 3

Marginal Ridges
 2

Buccolingual Inclination
 3

Overjet
 1

Occlusal Contacts
 5

Occlusal Relationships
 6

Interproximal Contacts
 0

Root Angulation
 0

INSTRUCTIONS: Place score beside each deficient tooth and enter total score for each parameter in the white box. Mark extracted teeth with "X". Second molars should be in occlusion.

Figure 11. ABO cast radiograph evaluation score

pretreatment and posttreatment cephalometric landmarks and measurements. The ABO cast-radiograph evaluation score was 19 in this case (Figures 9–11 and Table 2).

Overall, this case demonstrates that a good diagnosis coupled with an orthodontic treatment plan for a functional, healthy, and esthetic outcome can and will always be achieved through thoughtful consideration of all the alternatives. Extraction has been indicated as a more effective and efficient therapy than the current nonextraction preferences of orthodontists and patients.¹

Editor's Comments

The editor appreciates the authors' contribution to this issue of the *PCSO Bulletin* by presenting a case treated with an atypical extraction pattern. Correct diagnosis and proper treatment plans are always the keys to a satisfactory outcome.

Reference

1. Janson G, Maria FR, Bombonatti R. Frequency evaluation of different extraction protocols in orthodontic treatment during 35 years. *Prog Orthod* 2014;15(1):51. <https://doi.org/10.1186/s40510-014-0051-z>

Clinicians' Biography



Dr. Alexander Stacy

Dr. Alexander Stacy is currently a first-year orthodontic resident in the Postgraduate Orthodontic Program at the Arizona School of Dentistry & Oral Health. He also received his DMD degree from the Arizona School of Dentistry & Oral Health and his MS degree in cellular & integrative physiology from Indiana University.

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Dr. Seuss Kassisieh

Dr. Seuss Kassisieh received his BS and DDS degrees from the University of Iowa and his MS degree in orthodontics from Baylor College of Dentistry. For the last 28 years, he has been in private practice in Scottsdale and Paradise Valley, Arizona. He is the past president of The Southwest Component of the Edward H. Angle Society and past president of the Arizona Orthodontic Association. He is a Diplomate of the ABO and serves the College of Diplomates

of the ABO as an advocate for Board certification at the A. T. Still University of Arizona School of Dentistry & Oral Health Postgraduate Orthodontic Program, where he has been a part-time adjunct faculty member for 17 years. His educational seminars focus on evidence-based orthodontic treatment and contemporary orthodontic therapies. He also reviews the current ABO-recommended literature and prepares the residents for their written and clinical ABO examinations.

Call for Submitting Cases



Dr. Zhang, editor of the *PCSO Bulletin* Case Report column, sincerely invites you to send your case—either well treated or failed for any reason(s)—to be featured in an upcoming issue. This column welcomes any cases that cannot easily be found in orthodontic textbooks and for which there is an element of uniqueness regarding the malocclusion itself or the treatment. The editor also welcomes any comments or feedback on the published cases, preferably the Case Report featured in the most recent issue. If you have questions about submitting your case or sending your comments, please contact me at xingzhongzhang@atsu.edu.

Thank you,
John (Xingzhong) Zhang, DDS, MSD, PhD
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