

Open Bite Treated with Extractions and Temporary Anchorage Devices

Abstract

A 13-year-old female with a chief complaint of continuing treatment presented with Class I skeletal pattern and slight facial asymmetry. Intraorally, she had Class II molar relationship on the right side, class I on the left side and 3mm. of midline discrepancy. Her upper and lower incisors were proclined and slightly crowded. She had 1 mm. overbite and 5mm. overjet in initial mounted casts. Splint therapy was suggested to stabilize mandibular position. After splint wear, a new mounting was made, which resulted in an open bite from left second molars to right second molars. A visual treatment objective was prepared with four first bicuspid extractions. After 9 months, upper second molars were extracted and temporary anchorage devices (TADs) were placed in the upper arch for intrusion. Detailing strategies such as bracket repositioning, occlusal adjustment, and elastics were used. The role of segmented models, second molar extraction treatment, and superimposition analysis in patients with discrepancies in mandibular position is discussed. It is concluded that a thorough case workup is needed to provide patients with a successful treatment for open bite cases. This case was treated orthodontically in 2 years with four bicuspid and upper second molar extractions as well as vertical control with TADs.

Keywords: *Open bite, second molar extraction, vertical control*

Introduction

One of the challenges faced by orthodontists is open bite treatment.^[1,2] Two main strategies are available as treatment options for this dentofacial anomaly. It can be corrected by extruding anterior teeth and/or by intrusion of the posterior teeth. To select the best treatment plan for a case, the etiology of the open bite needs to be identified. Once the cause is determined, the correction strategy has to be designed. Some patients present decreased tooth exposure at rest. Certain habit problems tend to intrude and procline front teeth. In such situations, extrusion of anterior teeth might be an appropriate treatment plan. Mechanical strategies for these types of problems might include gingival bracket placement of incisors and anterior elastics.^[2-4]

On the other hand, many open bites are generated due to an increased growth of the posterior face height. These open bites are corrected with treatment strategies that try to attempt a vertical control or intrusion of posterior segments, which will result in a counterclockwise autorotation of the mandible. Mechanical strategies for this group include temporary anchorage devices (TADs), skeletal anchorage,

and extraction treatment with minimum anchorage.^[2,4,5]

To identify the etiology of the open bite and determine the most appropriate treatment plan for the patient, a careful assessment of the patient has to be made. With the purpose of making an accurate diagnosis, tools such as cephalometrics, facial analysis (with a proper study of hard and soft tissues), evaluation of tooth exposure were used.^[6] For example, if a patient has increased incisor exposure at rest, it is inadequate to attempt to close an open bite with anterior elastics.^[7] According to Ayala^[8] the best way to assess the relationship of incisors in an open bite is to visualize how these teeth relate to upper stomion. Ideally, the upper incisor has to be 4 mm below upper stomion. It should overlap 4 mm with the lower incisor. This means that the incisal edge of the lower incisors should reach the level of upper stomion. If lower incisors are underneath upper stomion, the mandible needs to autorotate until the lower arch is able to reach the upper lip. To achieve this goal, the best treatment plan is to intrude the back teeth and to counterclockwise rotate the lower occlusal plane.^[8] The case below is an example of this last open bite scenario. It has additional complexity since

**Carol Weinstein,
Ana Cruz¹,
Bárbara Feldman²**

Private Practive Santiago Chile and Private Courses, San Francisco de Asis 150 of 421, ¹Orthodontic Resident, University of Los Andes, ²Dentist in Public Health Facility, Santiago, Chile

Address for correspondence:
*Dr. Carol Weinstein, Private Practive Santiago Chile and Private Courses, San Francisco de Asis 150 Oficina 421, Vitacura, Santiago, Chile.
E-mail: carol@ortodonciaclinica.cl*

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the mandible was in an accommodated position which was “hiding” a severe open bite.

Case Report

A 13-year-old female presented with a chief complaint of continuing treatment. She had had early treatment with palatal expansion in our practice. She presented [Figures 1 and 2] with Class I skeletal pattern [Figures 3-6]. Slight facial asymmetry with larger right side than left side, Class II molar relationship

on the right side, and Class I on the left side (due to segment migration). There was 3 mm of midline discrepancy: upper midline deviated 1 mm to the right and lower midline deviated 2 mm to the left. There was biprotrusion of upper and lower incisors. She had 1 mm overbite and 5 mm overjet in initial mounted casts [Figure 7], slight crowding 2 mm in the upper and 2 mm in the lower arch, right temporomandibular joint with opening click, and lateral movements with group function and balancing interferences.



Figure 1: Pretreatment photos



Figure 2: Pretreatment photos



Figure 3: Pretreatment panoramic film



Figure 4: Pretreatment lateral cephalogram



Figure 5: Anteroposterior cephalogram

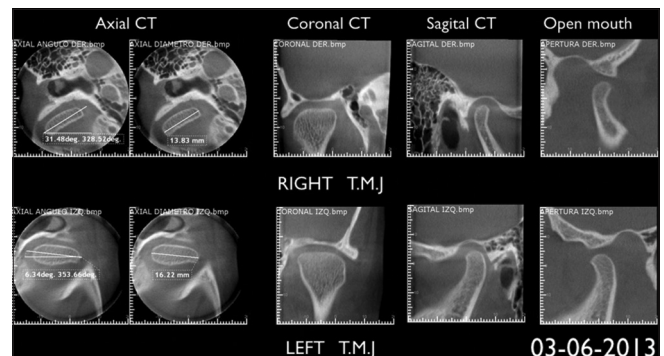


Figure 6: Pretreatment cone beam temporomandibular joints

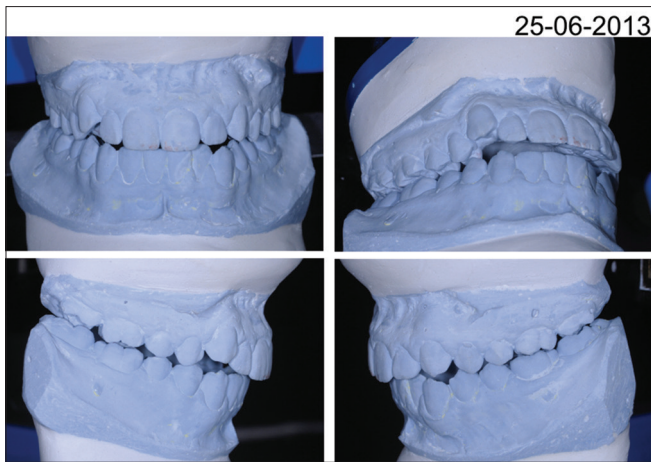


Figure 7: Initial mounted casts



Figure 8: Full-coverage splint



Figure 9: Bite change after 3 months of splint therapy



Figure 10: Lateral cephalogram after splint therapy

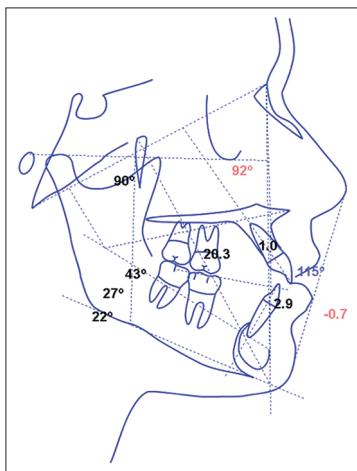


Figure 11: Ricketts cephalometric analysis

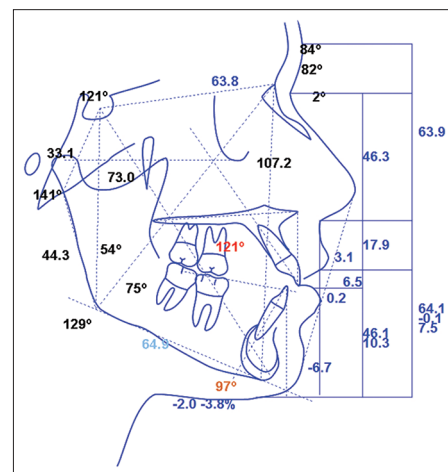


Figure 12: Jarabak and soft-tissue cephalometric analysis

A magnetic resonance imaging was requested which revealed right disc displacement with reduction. The image of the right condyle presented with irregular and flat surface compatible with degenerative joint disease. Models were mounted in a Panadent articulator and the mandible was shifted to a backward and more open position with first tooth contact in right second molars.

Treatment objectives

Splint therapy was suggested to stabilize mandibular position [Figure 8]. After 5 months, new records were taken

to reevaluate the case. The new mounting revealed open bite from second molar to second molar [Figures 9-12]. Segmented casts were used to evaluate whether the open bite could be closed orthodontically achieving an occlusion with appropriate overbite and overjet.

Treatment alternatives

A visual treatment objective was prepared with four first bicuspid extractions [Figure 13]. Space closure was planned with medium anchorage to reduce incisor biprotrusion and help bite closure, by moving molars forward and closing

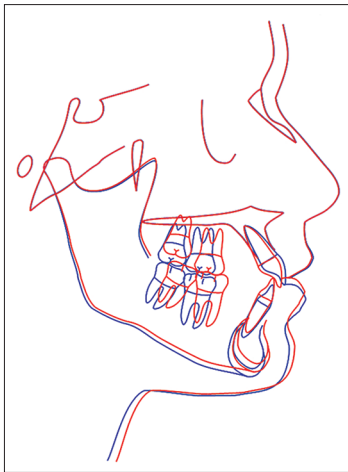


Figure 13: Visual treatment objective with four bicuspid extractions



Figure 14: Fixed appliances, complete clinical orthodontics prescription 0.014 lower heat activated nitinol wire, upper arch with closed coil to center midlines during alignment



Figure 15: Midlines almost centered during leveling and aligning phase. Anterior segment tied as a unit

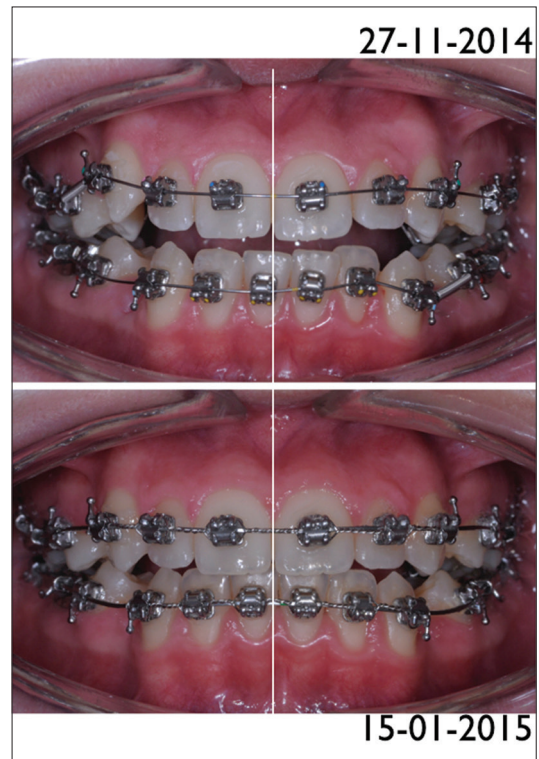


Figure 16: Midline correction during alignment



Figure 17: Lower stainless steel in upper arch 0.019 x 0.025 for width coordination. Remanent extraction space: 4, 5 mm left and 2 mm right. Lower space closure with sliding mechanics. Transpalatal arch for intrusion

the wedge, as part of a vertical control strategy.^[9-11] Intrusion of upper molars, with transpalatal arches, was also planned to close the open bite by generating mandibular autorotation and counterclockwise closure of the mandible. Further extractions and skeletal anchorage were left for future evaluation. A nonextraction plan was discarded as a possibility since it would have increased incisor proclination and would not help for bite closure.

Treatment progress

Once extractions of all first bicuspid were made, fixed self-ligated appliances were cemented. GAC, Complete Clinical Orthodontics prescription was used [Figure 14]. The case began

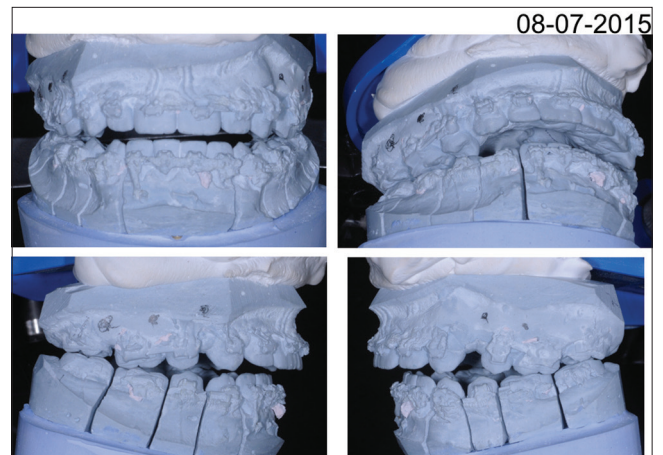


Figure 18: Progressive mounting with segmented casts

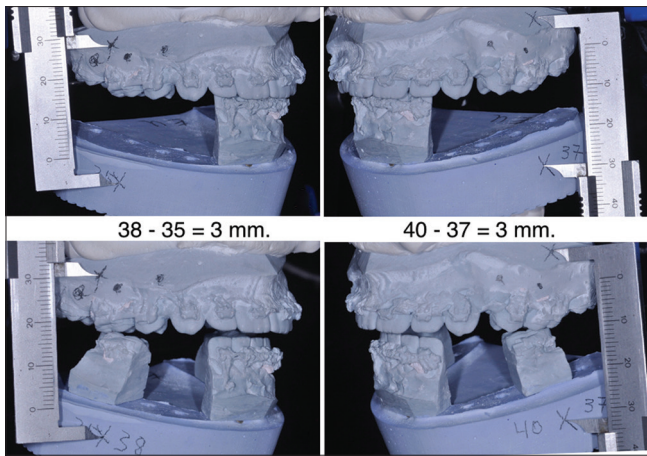


Figure 19: (a) Distance between two arbitrary dots in upper and lower casts, without tooth contact in posterior teeth. (b) Distance between two arbitrary dots with first molar contact



Figure 21: Intrusion of posterior segment. Retrusion of anterior segment using temporary anchorage devices

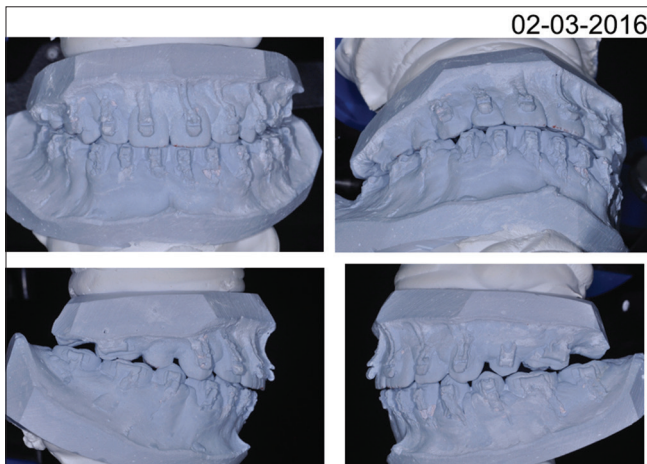


Figure 23: Progressive mounting for detail and finish stage

by leveling and aligning the arches with 0.014 heat activated nitinol wires. Closed coils were placed to help midline correction simultaneously with tooth alignment [Figures 15 and 16]. Archwire sequence included 0.020 × 0.020 heat activated NiTi, stainless steel 0.021 × 0.025 in the lower arch and 0.019 × 0.025 in the upper arch [Figure 17]. Transpalatal arches were used in the upper first and second molars. Sliding mechanics with lower coils activated to the lower first molar were used to close residual space in the lower arch.

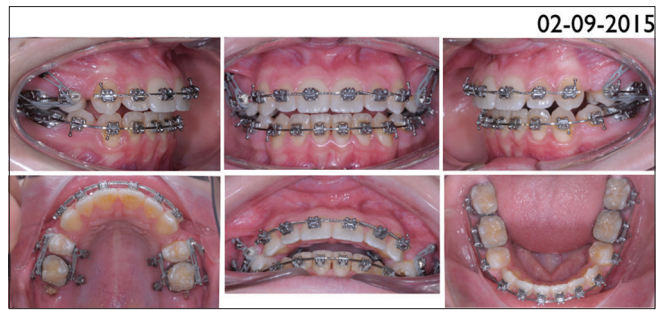


Figure 20: Upper second molar extractions, segmented upper arch, mini screws placement and activation

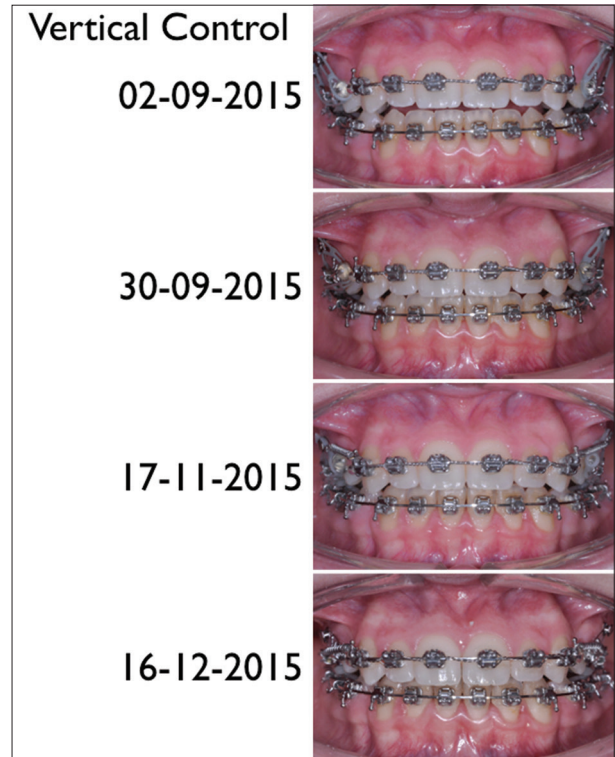


Figure 22: Vertical control



Figure 24: Right upper 51 was repositioned, lower stripping to help upper space closure triangular elastics

After 9 months of active treatment, progress records were taken [Figure 18]. The case was remounted with segmented models. At this point, lower spaces were closed and the open bite was still present. Arbitrary marks were made in the upper and lower casts at the level of the second molars.

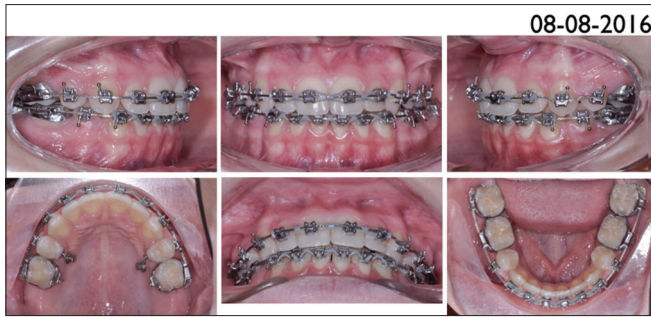


Figure 25: Stripping of lower incisors to close black triangles. Lower c-chain



Figure 26: Appliance removal



Figure 27: Retainer placement with rap around arch. Note occlusal stop in mandibular arch to avoid extrusion in second molar area

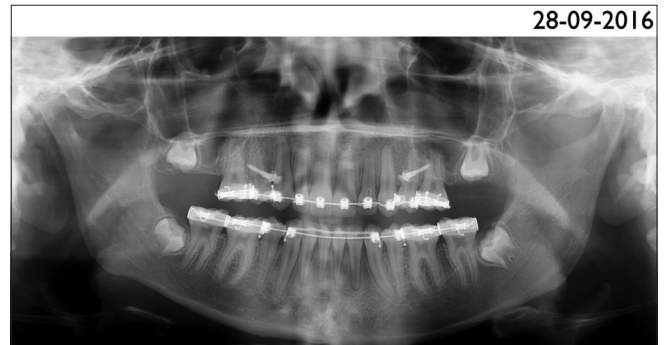


Figure 28: Final panoramic film



Figure 29: Final lateral cephalogram

A right and left vertical measurement was recorded on each side between the upper and lower reference. Posterior teeth were then removed [Figure 19] from the pinned models and the same measurements between the upper and lower arbitrary marks were recorded a second time. Interestingly, the bite closed after removing the back teeth showed an adequate overjet and overbite relationship of the front teeth. By performing this diagnostic exercise, it was concluded that the patient presented an open bite that could be corrected orthodontically, since it required 3 mm of intrusion of the back teeth. This movement is a feasible task that can be attempted with orthodontic mechanics. As stated by Proffit,^[12,13] it is within the envelopes of possible orthodontic correction.

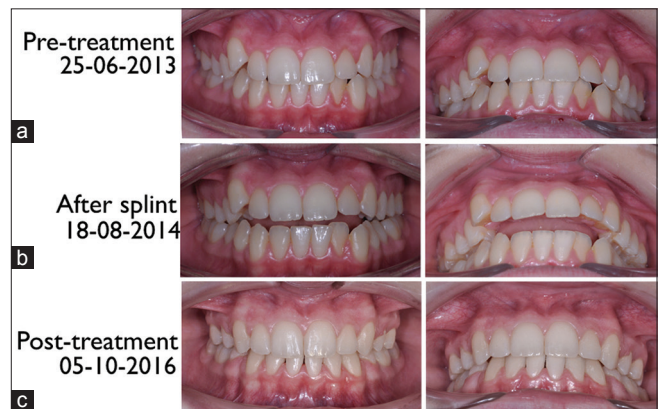


Figure 30: Frontal and overjet photographs (a) Pretreatment. (b) After splint. (c) Posttreatment

Since the patient presented with upper third molars, it was decided to remove upper second molars [Figure 20] in order to avoid having to do intrusion mechanics of these teeth. TADs were placed in the upper arch, in a buccal and palatal position, to intrude first molars and second premolars.

The upper arch was segmented and the posterior section was loaded with the miniscrews.^[14] In addition, the upper anterior segment was retracted using the TADs [Figure 21]. Lower teeth had stripping to improve the overbite.

Treatment results

Once spaces were closed and the desired intrusion was obtained [Figure 22]; continuous mechanics were resumed as part of the detail and finishing stage [Figure 23]. Brackets

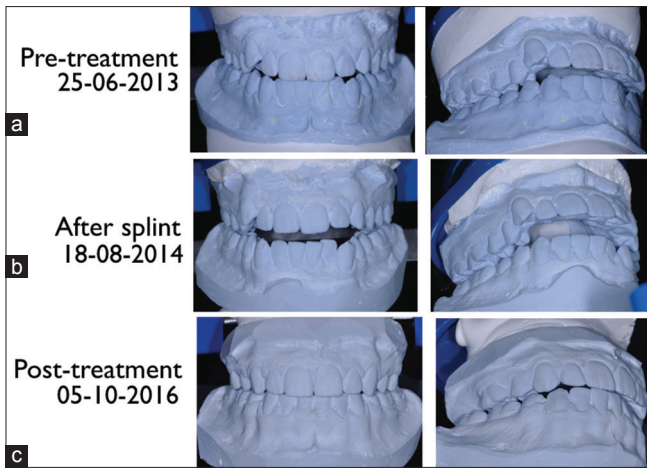


Figure 31: Frontal view casts (a) Pretreatment. (b) After splint. (c) Posttreatment

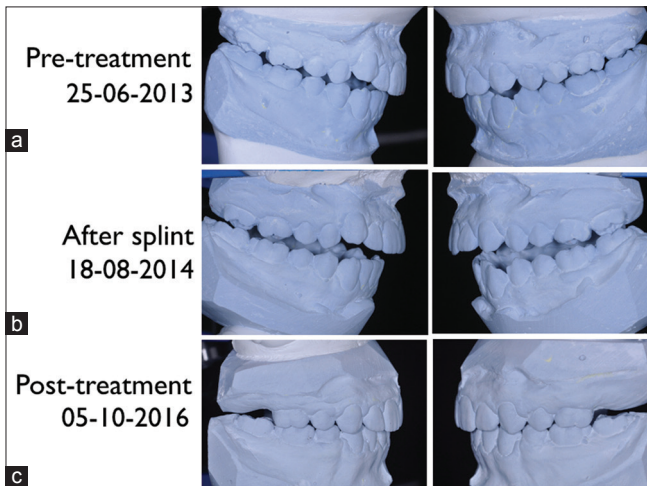


Figure 33: Lateral view casts (a) Pretreatment. (b) After splint. (c) Posttreatment

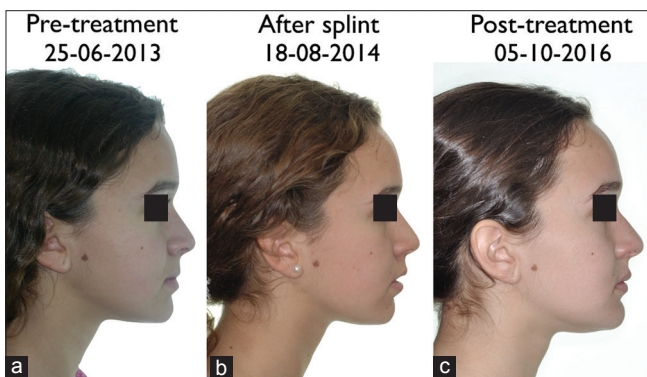


Figure 35: Right profile (a) Pretreatment. (b) After splint. (c) Posttreatment

were repositioned in the premolars and some posterior stripping was made to correct tooth size discrepancies of second upper and lower premolars [Figure 24]. Occlusal adjustment and elastics were also used as part of the detailing strategies [Figure 25]. The case was debonded after 2 years of active orthodontic therapy [Figures 26-29].



Figure 32: Lateral photographs (a) Pretreatment. (b) After splint. (c) Posttreatment

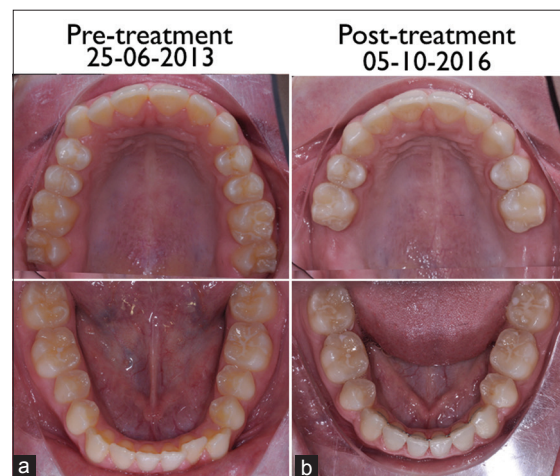


Figure 34: Upper and lower occlusal photographs. (a) Pretreatment. (b) Posttreatment

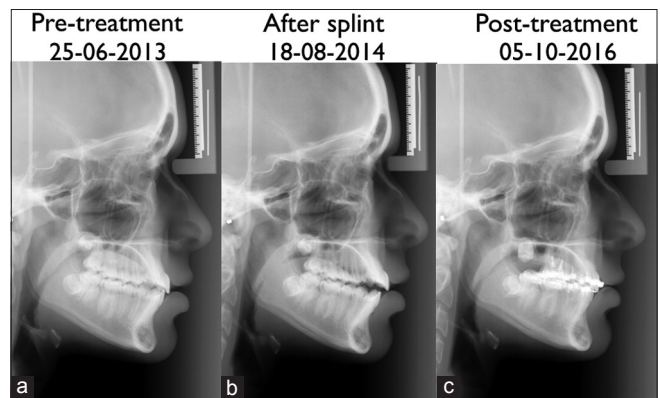


Figure 36: Lateral cephalogram (a) Pretreatment. (b) After splint. (c) Posttreatment

Discussion

To select the correct open bite treatment strategy for this case, segmented models played a significant role. Pinned models were the diagnostic tool that indicated the feasibility of treating this case with orthodontic mechanics avoiding

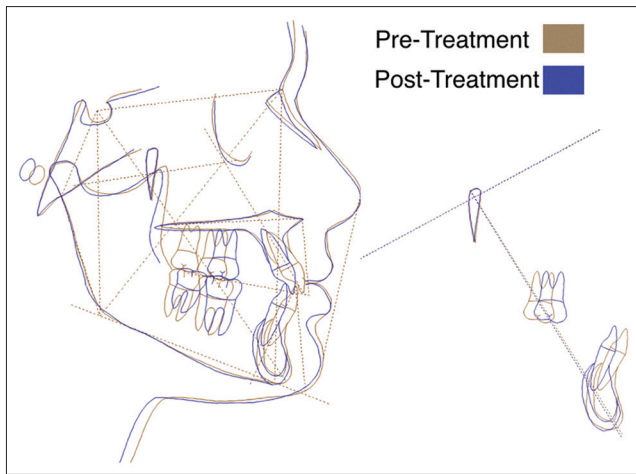


Figure 37: Superimposition of pretreatment and final tracing: Facial axis is maintained

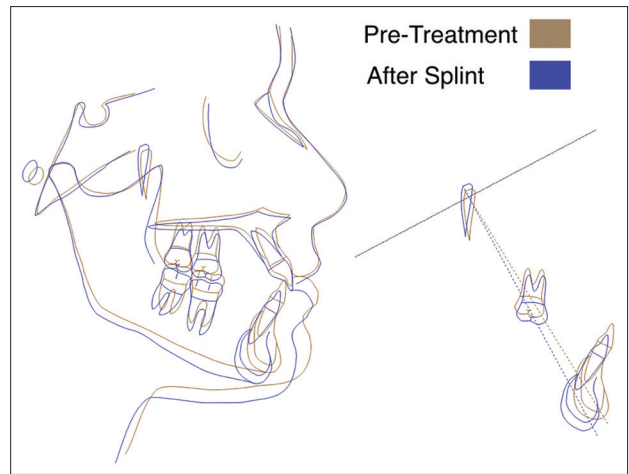


Figure 38: Superimposition of pretreatment and after splint tracing: Facial axis opens

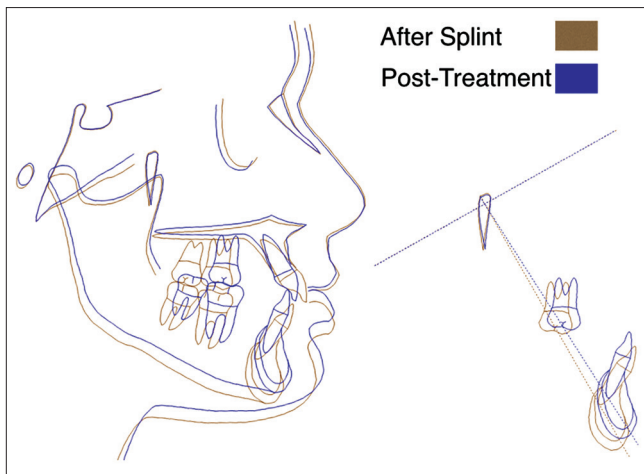


Figure 39: Superimposition of after splint and final tracing: Facial axis closes

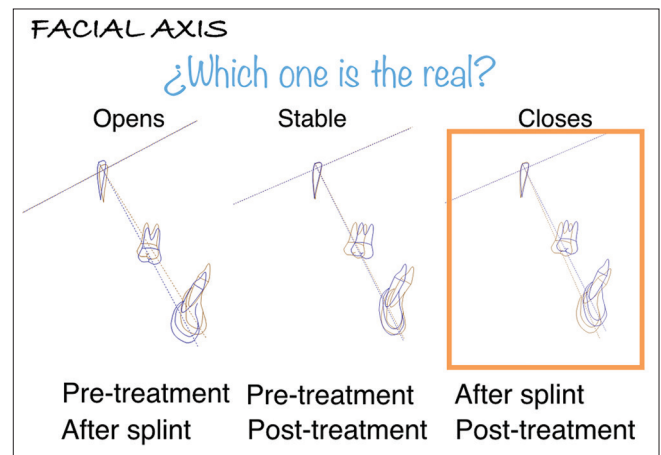


Figure 40: Analysis of facial axis changes when comparing different mandibular positions

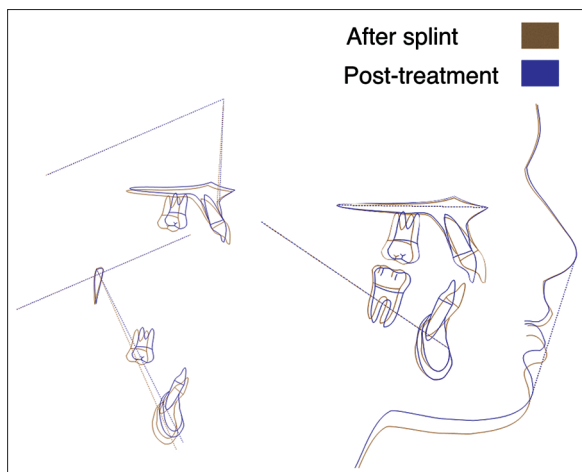


Figure 41: Superimposition areas between after splint and final tracings

the patient having to undergo an orthognathic surgery procedure. Pinned models as used in restorative dentistry are an extremely valuable tool to assure offering realistic expectations and mechanical strategies to the patient. In this particular case, the strategy to accomplish a 3 mm [Figure 19]



Figure 42: Six-month follow-up

decrease in posterior vertical dimension was a combination of second molar extractions and the use of TADs to intrude molars and premolars^[15,16] in combination. If pinned models would have revealed that 8 mm of intrusion were required to close the patient's open bite, orthognathic surgery would have been our suggestion to correct the case.^[17]

The second molar extraction treatment is also considered an effective alternative for open bite closure.^[18] However, it has the inconvenience that third molars not always erupt next to the first molars, and therefore, sometimes, minor

orthodontics is required to bring them into position.^[19,20] Timing is also an issue since third molars might not be erupted by the time active therapy is finished.^[21] In this case, at the time of appliance removal, precaution had to be taken in the lower retainer design to place a stop in the occlusal surface of the second molars to avoid extrusion due to a lack of tooth contact with the upper arch.

Superimposition analysis: When comparing the tracings, it can be observed that the patient presented with ideal upper exposure at rest and therefore her case had to be assessed with posterior intrusion rather than anterior extrusion. Comparison between initial and final lateral cephalometric clearly shows a significant improvement of lower incisor position [Figure 36]. After mandibular autorotation, the lower incisor coupled better with the upper and the incisal edge became closer to upper stomion. As stated by Ayala and Gutiérrez, this is a key factor in improving facial profile as well as upper and lower lip contour.^[8,22]

The final mounting shows a successful open bite closure with stable mandibular position. A careful comparison of before and after records needs to be made in order to adequately quantify the changes [Figure 30-35]. In the cephalometric analysis, to evidence the real modification, it is very important to compare the final result to the postsplint position of the mandible. When superimposing the initial records of the patient with the final records, we can observe that the facial axis was maintained [Figure 37]. However, the whole key in this case is that the patient was initially in an accommodated position of her mandible that was evidenced by the use of split therapy before her orthodontic treatment [Figure 38]. When comparing the postsplint open bite with the final treatment tracing [Figure 39], it is evident that the mandible autorotated [Figures 40 and 41]. The vertical dimension was controlled and the facial axis was closed.

Conclusion

Thorough case workup is needed to provide patients with a successful treatment for open bite cases. This case was treated orthodontically with four bicuspid and upper second molar extractions as well as vertical control with TADs [Figure 42].

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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