MedCrave
Step into the World of Research
Journal of Dental Health, Oral Disorders & Therapy

Case Report

Open Access
CrossMark

Lingual orthodontics: perfect union of aesthetic treatment with biomechanical efficiency - a case report

Abstract

The aesthetic treatment of dentoalveolar biprotrusion is one of the greatest challenges for the orthodontist. The present article aims to show an approach in an adult patient with Class I malocclusion associated with a biprotrusion who did not wish to have the aesthetics of her smile compromised during orthodontic treatment. The treatment plan consisted of installing a lingual orthodontic appliance to distalize the upper and lower teeth through absolute anchorage. At the end of the treatment, the malocclusion was corrected efficiently, aesthetically and quickly.

Keywords: teeth, malocclusion, braces, treatment

Volume 15 Issue 2 - 2024

Randerson Menezes Cardoso,[1] Altair Pacheco Pontes[2]

[1]Master's in Dentistry from the Federal University of Pernambuco (Brazil), Coordinator of the Lingual Orthodontics courses at the Complementary School of Esthetic Dentistry in São Paulo (Brazil) and Coordinator of the specialization course in Orthodontics at Orto-G / FACOP, in Recife (Brazil)
[2]Specialist in Orthodontics at Orto-G / FACOP, Brazil

Correspondence: Randerson Menezes Cardoso, Avenida Dezessete de Agosto, 335 sala 114-Parnamirim, Zip Code 52060-590, Recife, Pernambuco, Brasil, Tel +55(81) 99247-3396, Email contat@randersoncardoso.com.br

Received: March 27, 2024 | **Published:** April 18, 2024

Introduction

Orthodontics has undergone significant evolution over the last few decades. Among the various advances that have marked this specialty, Aesthetic Orthodontics is emerging as an area of growing interest for both professionals and patients. Combining the traditional principles of Orthodontics with an aesthetic approach, this area seeks not only to correct dental misalignments and occlusal problems, but also to promote facial harmony and an aesthetically pleasing smile during treatment.

With the search for aesthetic orthodontic solutions increasing, a variety of aesthetic orthodontic appliances have been offered to patients as options that minimize visual impact during treatment. Among these alternatives, aligners and lingual orthodontics have gained prominence, each presenting advantages and disadvantages.

Lingual Orthodontics represents a remarkable evolution in the field of orthodontics, offering a discreet approach to correcting dental problems. Unlike conventional braces, in which brackets and wires are applied to the visible surface of the teeth, Lingual Orthodontics uses the inner part of the teeth, providing significant aesthetic benefits.[1]

This method has stood out due to its biomechanical effectiveness and expressive results, while at the same time offering a discreet solution for those who wish to maintain the natural appearance of their teeth.[1] This article presents the clinical case of a patient with dental biprotrusion treated with lingual orthodontics.

Case report

Female patient, 21 years old, attended a private clinic in Recife -Pernambuco, Brazil for possible orthodontic treatment, reporting that she was not satisfied with her smile. In the clinical evaluation, mild antero-inferior crowding was observed (model discrepancy: -2.75mm); class I of canines and molars; and proclined incisors (Figures 1–7). In the cephalometric analysis, it was possible to confirm the maxilla and mandible were protruded in relation to the skull base (SNA = 91.98° and SNB = 89.85°); upper incisors excessively proclined and protruded (U1-NA =7.89 mm and U1.NA =33.72°); lower incisors well positioned and slightly protruded L1.NB =23.45° and L1-NB =5.78mm); closed nasolabial angle (70.56°); and balanced growth pattern (Table 1). During the anamnesis, the patient reported complaints of lower anterior crowding and protruding lips, as well as the desire for orthodontic treatment that would not compromise the aesthetics of her smile. Among the proposed treatments, the patient chose to use a lingual orthodontic appliance (individualized prescription) to distalize the upper and lower teeth with the aid of temporary anchorage devices (mini-screw). Therefore, the removal of the third molars was requested to begin the digital setup process and individualization of the brackets using the DIAD system described by Cardoso in 2019[2] and updated in 2023.[3]

Figure 1 Frontal intraoral image before treatment.

Figure 2 Right lateral intraoral image before treatment.

Figure 3 Left lateral intraoral image before treatment.

Figure 4 Upper occlusal intraoral image before treatment.

Figure 5 Lower occlusal intraoral image before treatment.

Figure 6 Lateral tele-radiography before treatment. Note the interincisal angle.

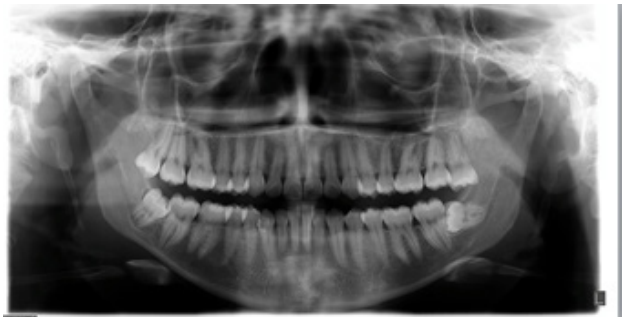

Figure 7 Panoramic x-ray of the jaws before treatment.

Table 1 Cephalometric measurements before and after orthodontic treatment

Measurements	Before treatment	End of treatment
SNA	91,98°	92,72°
SNB	89,85°	87,26°
S-N.Go-Me	31,65°	34,45°
Go-Gn.Ocl	33,19°	20,58°
U1-PP	125,49°	110,19
IMPA	81,95°	87,33°
U1-L1 (Interincisor angle)	120,71°	132,19°
U1-SN (Upper incisor inclination)	125,69°	106,03°
U1.NA (Upper incisor inclination)	33,72°	13,31°
U1-NA (Upper incisor position)	7,89mm	0,63mm
L1.NB (Lower incisor inclination)	23,45°	29,03°
L1-NB (Lower incisor position)	5,78°	4,99mm
U6-NA (1° upper molar –NA)	21,31mm	27,50mm
L6-NB (1° lower molar –NB)	15,89mm	21,06mm
L1-Apo (Horizontal position of the lower incisor)	3,79mm	2,35mm
Nasolabial angle	70,56°	97,43°

As a result, indirect bonding of all teeth was performed, except for the lower incisors using the KommonBase[4] technique. The process of aligning and leveling the upper dental arch occurred with the following sequence of wires: 0.010" Niti; 0.012"TMA; 0.014" TMA; 0.016" TMA; 0.018" TMA; 0.016" X 0.016"TMA; 0.016 X 0.022" TMA; and 0.016" X 0.022" steel (Figure 8). For the lower arch, the first wire used was 0.016" passively formed steel. With the insertion of the arch, 12mm steel mini-screw with 2mm in diameter were installed in the buccal shelf region and aesthetic buttons on the vestibular side of the lower canines for the insertion of elastic chains from the buttons to the mini-screw (170g on each side) (Figure 9). The elastics were changed every month and remained until the distalization of the posterior segments (right and left) completely dissipated the anterior crowding (Figure 10). With the distalization of the posterior segments, diastemas appeared in the antero-inferior region and the canines and molars began to relate to class II (Figures 11 & 12). Soon after, the missing brackets (lower incisors) were glued and, now, the alignment and leveling of the lower arch began with the following sequence: 0.014" TMA; 0.016" TMA; 0.018" TMA; 0.016" X 0.016"TMA; and 0.016" X 0.022" TMA (Figure 13). All arches were formed according to the template determined in the DIAD[3] system (Figure 14).

Citation: Cardoso RM, Pontes AP. Lingual orthodontics: perfect union of aesthetic treatment with biomechanical efficiency - a case report. *J Dent Health Oral Disord Ther.* 2024;15(2):61–67. DOI: 10.15406/jdhodt.2024.15.00615

Figure 8 Alignment and leveling phase of the upper dental arch.

Figure 9 Beginning of inferior distalization. The 0.016" steel arch was passively inserted for distalization through temporary anchoring devices located in the external oblique line. The lower incisors did not receive brackets at this stage to avoid proclination of the incisors.

Figure 10 Evolution of inferior distalization.

Figure 11 Right lateral view during the lower distalization phase. Patient presenting increased over jet and canine class II canine.

Figure 12 Left lateral view during the lower distalization phase. Patient presenting increased over jet and canine class II canine.

Figure 13 End of distalization and beginning of mechanics of the lower incisors, with bracket gluing and elastic chain to close the slight diastema presented by the distalization of the posterior teeth. Note that nature itself took care of dispelling the crowding.

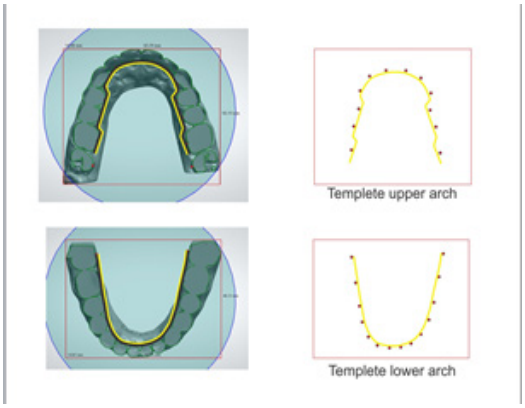

Figure 14 Template used to diagram the upper and lower arches obtained using the DIAD technique.

To complete the alignment and leveling of the upper arch, titanium mini-screw measuring 10 mm in length, 1.5 mm in diameter and 2 mm of transmucosus were installed in the tuber region for distalization of the upper arch until the canines entered class I again (150 g on each side) (Figure 15). With the end of distalization of the upper arch, new orthodontic documentation was requested to evaluate the new tooth positioning, root parallelism and degree of facial impact, especially of the lips (Figures 16 & 17). After assessment by the orthodontist of the aforementioned factors and by the patient of facial aesthetic and smile issues (Table 1), intercuspation was performed with inter maxillary elastics and the device was removed after 21 months of treatment. With the device removed, retainers were made with thermoplasticized PET-G plates (0.75mm), recommending daytime use for 6 months and a further 12 months at night (Figures 18–22).

Citation: Cardoso RM, Pontes AP. Lingual orthodontics: perfect union of aesthetic treatment with biomechanical efficiency - a case report. *J Dent Health Oral Disord Ther.* 2024;15(2):61–67. DOI: 10.15406/jdhodt.2024.15.00615

Figure 15 Beginning of upper arch distalization with mini-implant in the maxillary tuberosity. Distalization was performed in a single step to avoid diastemas in the smile region.

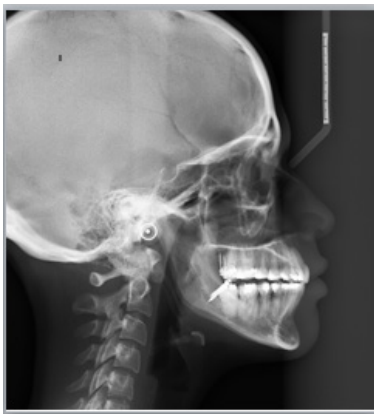

Figure 16 Lateral cephalogram of the face performed after distalization (upper and lower). Observe an increase in the interincisal angle and the posterior open bite.

Figure 17 Panoramic radiograph of the jaws after distalization.

Figure 18 Post-treatment frontal intraoral image.

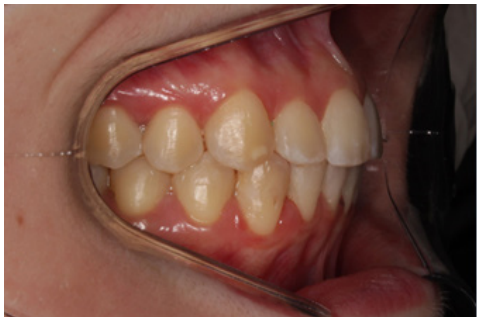

Figure 19 Right lateral intraoral image after treatment.

Figure 20 Post-treatment left lateral intraoral image.

Figure 21 Post-treatment upper occlusal intraoral image.

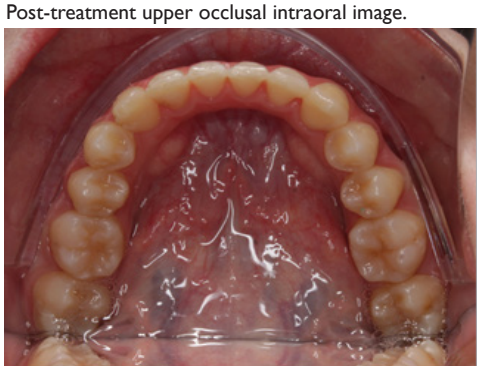

Figure 22 Post-treatment lower occlusal intraoral image.

Discussion

The orthodontic market currently offers aligners and lingual orthodontics to patients who want aesthetic treatment, despite there being a tendency in the Brazilian market towards treatments with aligners. As the patient was very specific about her need for aesthetic treatment, the advantages, and disadvantages of each of the techniques were discussed so that she could support her decision. The patient rejected the possibility of treatment with aligners due to the high possibility of inserting attachments into the anterior teeth, as

Citation: Cardoso RM, Pontes AP. Lingual orthodontics: perfect union of aesthetic treatment with biomechanical efficiency - a case report. *J Dent Health Oral Disord Ther.* 2024;15(2):61–67. DOI: 10.15406/jdhodt.2024.15.00615

this could compromise the aesthetics of her smile. This perception/decision was not exaggerated, as it ends up in line with research by Forsch et al.,[5] where the authors conclude the high degree of aesthetic compromise of aligners when they receive attachments.

Regarding the treatment possibilities for biprotrusion, we find in the literature: 1) simple maintenance of biprotrusion - this is done every time the patient feels satisfied with the degree of projection of the teeth and lips;[6] 2) the indication of premolar extraction - even though this is a good treatment alternative in terms of results, some patients tend to refuse treatment with extractions in the visible area of the smile;[6,7] 3) extractions of first molars –this is not a routine procedure in the orthodontic clinic due to the amount of space created[8]; 4) approaches such as bi-maxillary orthognathic surgery –a very interesting alternative when there is evidence of good skeletal impairment;[6] 5) interproximal wear –an option with low impact on improving dental biprotrusion;[8] 6) use of skeletal anchorage miniplates;[9] 7) and mini-screw. The last two alternatives allow very effective and similar treatments. However, the disadvantages of using mini plates compared to mini-screw include the need for more invasive installation and removal surgery, higher costs, and a greater likelihood of infection.[9]

The option of tooth extraction (premolars or molars) was not well received due to the likelihood of aesthetic compromise in the visible area of the smile during treatment and the possibility of negative impact on the face post-treatment, since the lingual appliance has good anchorage control,[10,11] and the retraction of the anterior teeth could excessively increase the nasolabial angle and excessively reduce the exposure of the vermilion of the upper lip.[12]

Although the increase in the nasolabial angle is beneficial for the patient's aesthetics, the reduction in the exposure of the vermilion of the upper lip at rest, for a woman, would be anti-aesthetic.[13] Therefore, we opted for distalization with mini-screw, as in addition to making the procedure less invasive, lower cost, and lower risk of infection,[9] we could control and measure the degree of distalization. With the form of treatment for biprotrusion defined, only the degree of distalization remained open so that it did not excessively impact the face.

To manage the case, the use of individualized brackets was recommended to reduce the risk of imperfections in tooth positioning at the end of treatment. If the patient had any poor dental positioning at the end of treatment, we could attribute the problem to: 1-failure in the setup or 2-failure in the bonding process. To eliminate the possibility of failure to position the individual trays during bonding, we can use the bonding guides of the DIAD system, where the individual trays of the KommonBase[3] technique are incorporated, a steel wire positioned along the dental axis in the vestibular to guide the correct positioning on the tooth during indirect bonding, serving as a double check for the adaptation of the trays (Figures 23–26).

Figure 23 Individual trays made with the DIAD system bonding guides.

Figure 24 Individual trays made with the DIAD system gluing guides.

Figure 25 Adaptation of the transfer tray with the DIAD system gluing guide on the upper right central incisor, the guide serves as a double check to verify the tray's adaptation to avoid insertions with incorrect angulations.

Figure 26 Adaptation of the transfer tray with the DIAD system bonding guide on the upper left canine. After the bracket has polymerized, the tray and guide will be removed.

As clinically the lower central incisors were lingualized in relation to the lower lateral incisors and radio graphically they presented a good positioning (L1.NB =23.45°; IMPA=81.95°), the lower central incisors were used as a positioning reference anteroposterior end of the dental arch.

At the beginning of treatment, initial distalization of the right and left posterior segments (second molar, first molar, second premolar, first premolar and canine) was performed to dissolve the lower antero crowding and avoid unwanted initial proclination of the incisors. (jigging movements), increasing treatment time and the chances of root resorption.[14]

During the distalization of the mandibular teeth, we observed a movement pattern within the expected range, with the maintenance of the positioning of the central incisors and distalization in the body of the molars (Figure 27). For the upper teeth, we opted for mass distalization to avoid the creation of diastemas in the dental arch and consequently compromising the aesthetics of the smile (very characteristic in two-step distalizations).[15] During distalization in the maxilla, the force applied originated from the mini-screw located in the tuberosity and the point of application of the force in the arch itself. This angle of force application favored the correction of vestibularization, since the force in the anterior region of the arch was passing below the center of resistance, but as a side effect, it led to the intrusion of the posterior teeth[16] (Figure 28). Due to the side effect presented, the patient developed a posterior open bite at the end of distalization, requiring the use of inter-cuspidation elastics to correct the problem.

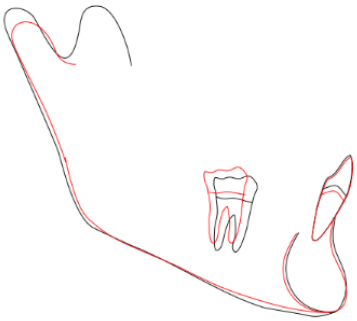

Figure 27 Overlay of cephalometric tracings of the mandible demonstrating tooth movement during treatment.

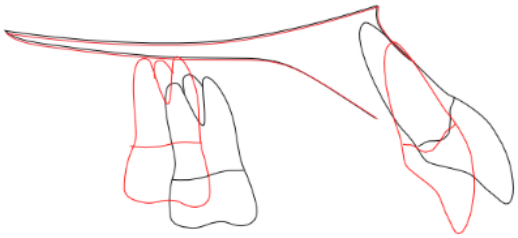

Figure 28 Overlay of cephalometric tracings of the maxilla demonstrating tooth movement during treatment.

At the end of the treatment, it was possible to verify the success of the treatment through the clinical conditions presented and the superimposition of the cephalometric tracings (Figure 29).

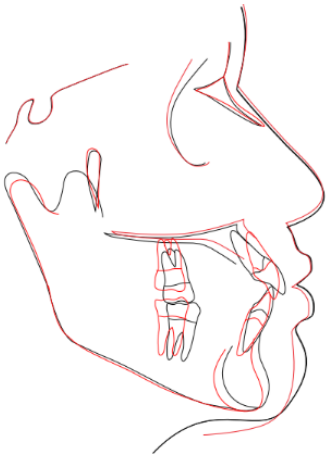

Figure 29 Total overlap of cephalometric tracings in SN with registration in S demonstrating tooth movement during treatment.

Conclusion

This case report highlights lingual orthodontics as an effective and aesthetically favorable alternative for the treatment of biprotrusion. The results obtained indicate that this approach can be considered a viable option, providing the much-desired correction. Additional studies are needed to consolidate these observations and further improve the understanding and application of mechanics in cases of biprotrusion.

Acknowledgments

None.

Conflicts of interest

The authors declare that there are no conflicts of interest.

References

1. Ahmed S, Alghabban R, Alqahtani A, et al. Evidence of effectiveness of lingual orthodontics as an alternative to conventional labial orthodontics. a systematic review. *Cureus*. 2024;16(1):e51643.

2. Cardoso RM, Eto LF. Digital design of the ideal arch (DIAD): description of the technique. *Ver Clin Ortod Dental Press*. 2019;18:68–78.

3. Cardoso RM. Digital ideal archwire design (DIAD) in lingual orthodontics: technique update. *J Dent Health Oral Disord Ther*. 2022;13(4):98–103.

4. Komori A, Takemoto K, Shimoda T, et al. Precise direct lingual bonding with the kommonbase. *J Clin Orthod*. 2013;47(1):42–49.

5. Försch M, Krull L, Hechtner L, et al. Perception of esthetic orthodontic appliances: an eye tracking and cross–sectional study. *Angle Orthod*. 2020;90(1):109–117.

6. Bills DA, Handelman CS, BeGole EA. Bimaxillary dentoalveolar protrusion: traits and orthodontic correction. *Angle Orthod*. 2005;75(3):333–339

7. Schroeder MA. Má oclusão Classe I de Angle, com acentuada biprotrusão, tratada com extrações de dentes permanentes. *R Dent Press Ortodon Ortop Facial*. 2009;14(4):137–148.

8. Pinzan A, Garib DG, Henriques JFC, et al. Tratamento de correção de biprotrusão com extrações de quatro primeiros molares permanentes. *Sci Pract*. 2016;9(35):139–145.

9. Faber J, Morum TFA, Leal S, et al. Miniplates allow efficient and effective treatment of anterior open bites. *Rev Dent Press Ortodon Ortop Facial*. 2008;13(5):144–157.

10. Geron S. Anchorage considerations in lingual orthodontics. *Semin Orthod*. 2006;12(3):167–177.

11. Geron S, Vardimon A. Six anchorage keys used in lingual orthodontics sliding mechanics. *World J Orthod*. 2003;3(4):258–265.

12. Almeida FM, Neves IS, Pareira TJ, et al**.** Avaliação do ângulo nasolabial após o tratamento ortodôntico com e sem extração dos primeiros pré–molares. *Rev Dent Press Ortodon Ortop Facial*. 2008;13(6):51–58.

13. Proffit WR, Fields HW, Larson BE, et al. *Ortodontia Contemporânea*. 6 Ed. Rio de Janeiro: GEN Guanabara Koogan. 2021.

14. Consolaro I, Martins–Ortiz MF. Em busca de uma causa à parte da Ortodontia: Hereditariedade e reabsorção apical em pacientes tratados ortodonticamente. Uma análise crítica do trabalho de Harris, Kineret e Tolley. *Rev Dent Press Ortodon Ortop Facial*. 2004;9(2):123–135.

15. Khlef HN, Hacker MY, Ajaj MA, et al. Evaluation of treatment outcomes of en masse retraction with temporary skeletal anchorage devices in

comparison with two–step retraction with conventional anchorage in patients with dento alveolar protusion: a systematic review and meta analysis. *Contemp Clin Dent*. 2018;9(4):513–523.

16. Hong RK, Heo JM, Há YK. Lever–arm and mini–implant system for anterior torque control during retraction in lingual orthodontic treatment. *Angle Orthod*. 2005;75(1):129–141.

Citation: Cardoso RM, Pontes AP. Lingual orthodontics: perfect union of aesthetic treatment with biomechanical efficiency - a case report. *J Dent Health Oral Disord Ther.* 2024;15(2):61–67. DOI: 10.15406/jdhodt.2024.15.00615