

## Case Report

# Updating the orthodontic envelope of discrepancy: Canines transposition

### ABSTRACT

This study aimed to report a case of skeletal Class I adult with anterior open and transposed upper canines with premolars and lower right canine transposed with lateral incisor, retained upper deciduous C, B, and lower right C. With congenital missing upper right lateral incisor, upper spacing arch, and lower mild crowding arch, a patient complains about her smile esthetic. The case was treated using temporary anchorage devices and three-dimensional retraction loops designed primarily for upper canine transposition with an accepted esthetic reshaping of lower canine using composite restoration. The missing lateral had been implanted with smile makeover using microesthetic postorthodontic treatment. After 16 months of treatment, it was possible to see a significant improvement of the patient's facial profile, with overcorrection in overjet and preservation of the tissues and integrity of dental roots.

**Keywords:** Canine, reshaping, temporary anchorage devices, transposition

### INTRODUCTION

The transposition is defined as “the positional interchange of two adjacent teeth, or the development or eruption of a tooth into a position normally occupied by a nonadjacent tooth.”<sup>[1]</sup> The cause of transposition was a matter of debate between the literature. While some advised for a genetic predisposition,<sup>[2]</sup> others claimed environmental factors that allowed the problem to happen.<sup>[3]</sup> Such environmental factors included crowding, spacing, and crossbites. In other literature, the support for the multifactorial origin of the problem was the belief.<sup>[4]</sup> The combination of interchanging factors leads to a dramatic transposition in many orthodontic cases. The code that was used to classify transposition in the literature was in three sections.<sup>[5]</sup> First, you should mention the arch where the incident happened. Then, you had to specify the transposed tooth by abbreviation. Finally, one must indicate the other tooth deviated from its place to allow the transposed tooth to fit within the arch. The most frequent arch to suffer transposition was the upper arch with up to

76% chance.<sup>[6]</sup> Usually, the incidence happened unilaterally by 88%.<sup>[6]</sup> Although transposition was not very common in orthodontic clinics (0.33% of the population),<sup>[7]</sup> they presented a real challenge in treatment. The transposition was expressed in many faces.<sup>[2,4]</sup>

In some cases, the canines were transposed into incisors or premolars positions. In other situations, the incisors suffered transposition with the premolars or with each other. Last but not least, the premolars showed interchange with the molars or with the canines. In all situations, according to the orthodontic envelope of a discrepancy, the classical treatment protocol was to accept...accept...accept.<sup>[8]</sup> Any chance to correct transpositions in the past had led to either

### HASAN SABAH HASAN, MOHAMED A. ELKOLALY<sup>1</sup>

Department of Orthodontic, Khanzad Teaching Center, General Directorate of Hawler-Ministry of Health, Erbil, Iraq,  
<sup>1</sup>Department of Orthodontic, Royal Dental Center, Alexandria, Egypt

**Address for correspondence:** Dr. Hasan Sabah Hasan, Department of Orthodontic, Khanzad Teaching Center, General Directorate of Hawler-Ministry of Health, Erbil, Iraq.  
E-mail: hsh.ortho@yahoo.com

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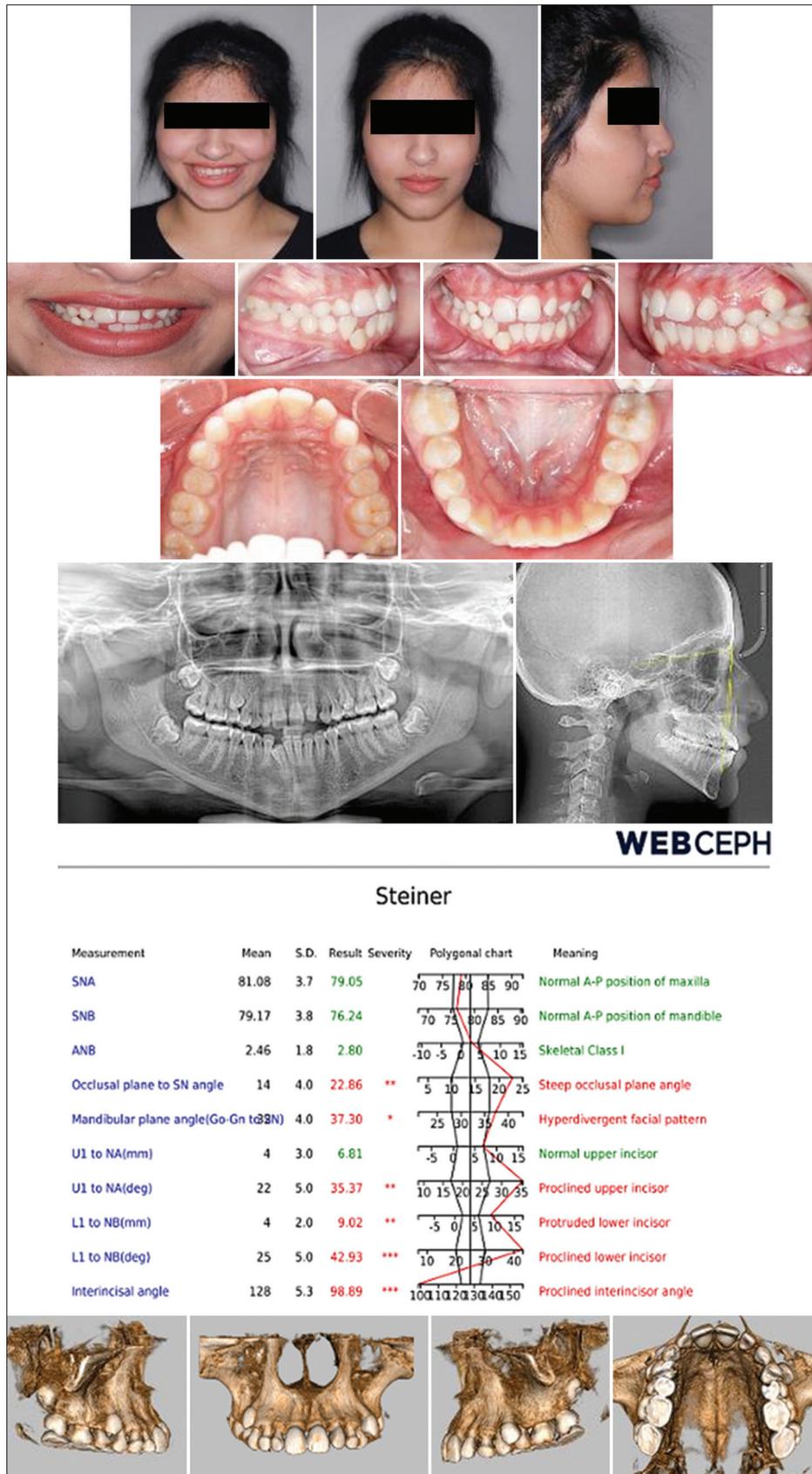


Figure 1: Initial clinical aspect of the patient including (pretreatment extra and intraoral pictures with panoramic X-ray and lateral cephalometric X-ray with tracing confirmed by cone-beam computed tomography)

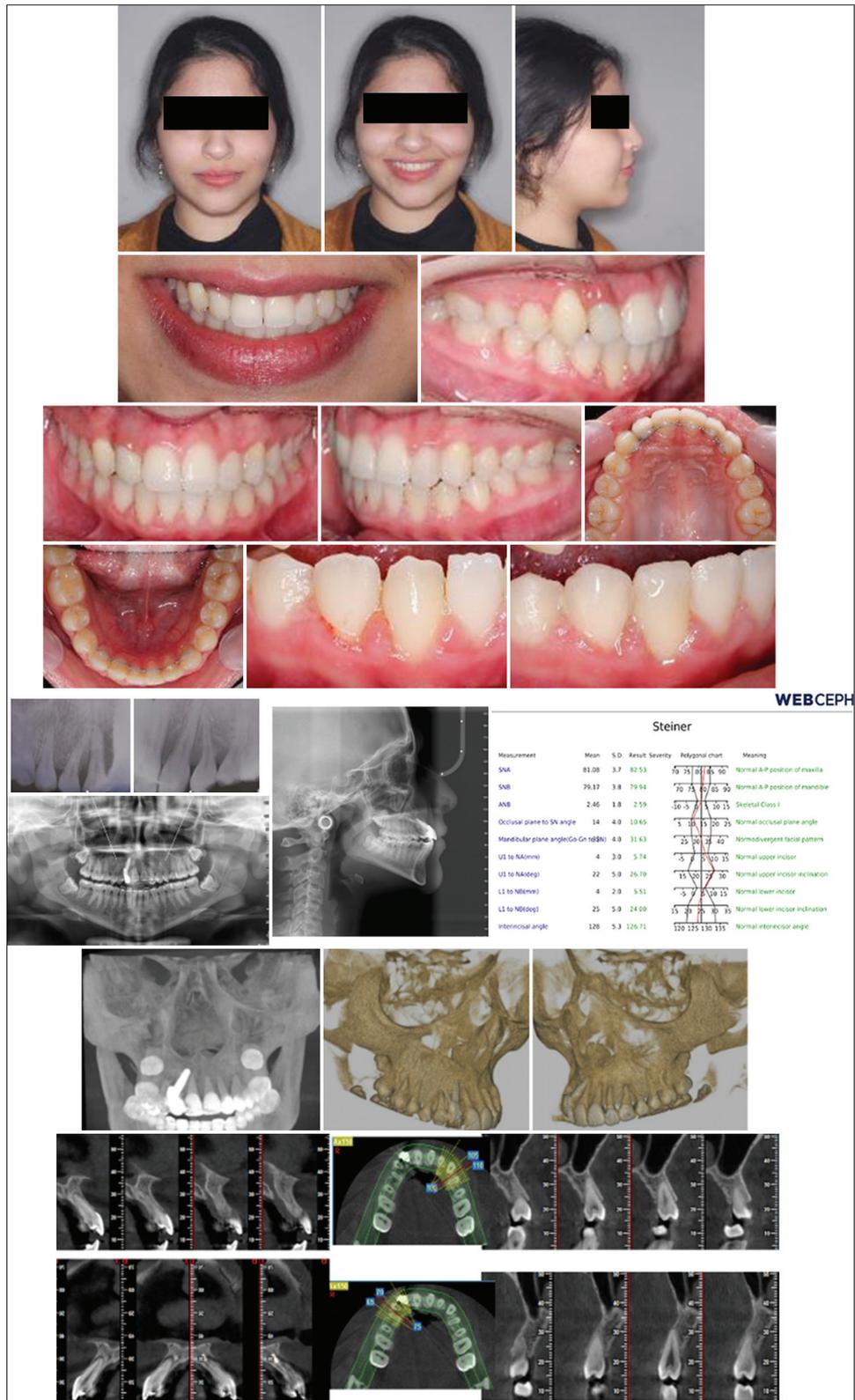


Figure 2: Final clinical aspect after orthopedic treatment including extra and intraoral pictures with preapical, cephalometric (include tracing), and cone-beam computed tomography radiograph

root resorption or periodontal ligament origin (PDL) damage. Recessions, bone fenestrations, and/or PDL destructions were the usual outcomes faced during corrections.<sup>[8]</sup> In modern

orthodontics, the introduction of temporary anchorage devices (TADs) and improved mechanical abilities through asymmetric mechanics and auxiliaries allowed the expert

clinician to expand his abilities and solve problems that were impossible to handle in the past. This article presented a case report of upper and lower canine transposition, complicated by the upper right deciduous lateral incisor. The case was managed by correcting the upper transposed canines, replacing the upper missing deciduous lateral incisor by implanting and accepting the molar transposition to reach optimum esthetic and functional goals.

## CASE PRESENTATION

The case SJ was a young Iraqi female, 20 years and 4 months of age. She presented with a chief complaint of “My teeth have spaces and they do not look good when I smile.” She showed a multifactorial problem list, which was better explained under the following sections: Figure 1.

- Pathological problems: Thin gingival biotype and small enamel carious pits
- Functional problems: Forward tongue posture within the open bite that complicated the situation
- Skeletally: The patient was Class I in jaw relationship and high Maxillo-mandibular plane angle (MMP) angle but normal lower third of the face
- Her upper arch presented moderate crowding, with proclined upper incisors. The arch was symmetric anteroposterior but had an upper midline 1 mm shift to the facial midline. Retained right and left Deciduous canines (Cs) together with retained right B were evident. Right and left upper canines were transposed and impeded in eruption with the upper first premolars [Figure 2]
- There was moderate crowding regarding the lower arch; proclined lower incisors and retained lower right C. The lower right canine was transposed with the lower right lateral incisor and was impeded from the eruption. The arch was symmetric in an anteroposterior direction, but the lower midline was shifted 2 mm to the left in relation to the facial midline [Figure 2]
- The incisors presented with Class III edge-to-edge relationship, together with 2 mm open bite and midline shifting from the facial [Figure 3]
- The right canines had been in Class III 1½ unit with open bite 4 mm and overjet 0 mm, but the left canines were in Class III 2 unit relationship with open bite 4 mm and increased overjet [Figure 3]
- The right and left posterior teeth were in very good occlusion; however, the molars were in Class I good interdigitation with normal overjet [Figure 3]
- The extraoral soft-tissue analysis revealed a mesoprosopic face with vertical equal thirds and equal transverse fifths, but the outer fifths were concealed by hair. Macrosomia and wide smile were evident together with thick

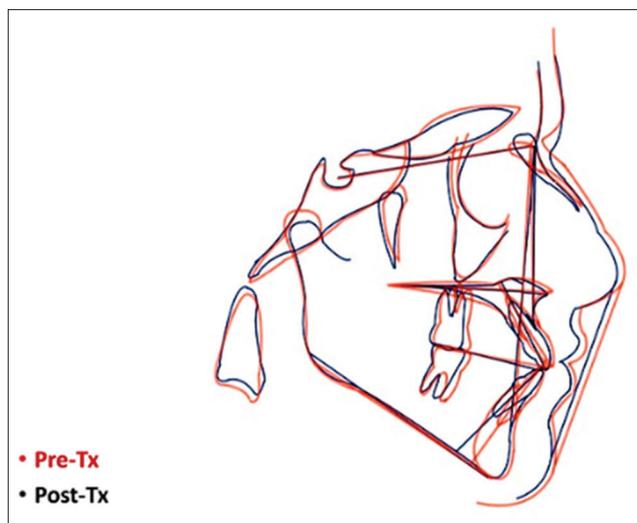


Figure 3: Cephalometric superimposition

eyebrows, wide nasal bridge, and blunt nose tip. There were asymmetric chin buttons, asymmetric gummy smile, asymmetric buccal corridors, and a canted ant occlusal plane. The upper midline shifted 1 mm right to the facial with a nonconsonant smile arc. There were good malar eminences, good submalar triangles, but the left eye was smaller than the right eye [Figure 4].

## Treatment objectives

The aims and objectives were set for the treatment of that case according to the following categories. The great need was directed to correct the smile esthetics, to close the spaces, and align the teeth to fulfill the patient’s chief complaint. Training the patient to stop the tongue-thrusting habit is critical for stability. Great care to keep the teeth in the middle of the bony confinement to avoid any recessions. Elimination of the retained teeth, arch adjustment, and canines’ transposition were mandatory for the best esthetic outcome. Correction of incisors torque and replacement of the missing lateral incisor was essential for stability. Achieving Class I incisor, canine and molar relationships with good overjet and overbite were the goal of perfect esthetics and stability.

## Treatment planning

Exercises are provided for the patient to correct the tongue-thrust habit. The retained deciduous teeth were extracted in the upper and lower arches. Use fixed orthodontic appliance with MBT prescription on all teeth except the upper incisors, where Roth prescription was used. The MBT prescription is known for more labial torquing in teeth than the Roth prescription except in the area of the upper incisors, where the Roth prescription showed more labial root inclination. We needed such planning to help correct the incisors’ inclination without the need to extract



Figure 4: Posttreatment 3-year follow-up

permanent teeth. The slot size was selected to present 0.018 inches for the anteriors, but 0.021 for the posteriors to provide effective torque control. TADs were used to control the precise movement to adjust upper canines' positions without risking recession occurrence. The lower canine had a small size and planned to be accepted in place and reshaped by cusp removal. A dental implant was planned to replace the missing lateral incisor. Widen both arches and broaden

the smile to decrease the buccal corridors and improve the esthetics were implied. The canted occlusal plane was corrected, and symmetrical arches were achieved to correct the midlines and the asymmetric gummy smile.

#### Treatment alternatives

The classic protocol to accept the maxillary transposition was rejected in this case, and we had the ability to expand

our limits and correct the smile to a better shape. The lower canine transposition was accepted. Any trial to correct that would have resulted in damage to the periodontium.

### Treatment progress and mechanics

The patient was instructed to practice the exercise to swallow water 60 times/day with tongue up and back touching the palate. This helped to reprogram the tongue position into the adult form of swallowing and eliminate the tongue thrust<sup>[9-11]</sup> TADs were used in the maxillary buccal sulcus, 8 mms length and 1.6 mm diameter on the right and left side. The fixed orthodontic appliance was fitted on teeth in the upper and lower arches as planned. A bracket placed on the central incisor toward the implant side was selected to show reversed angulation (the contralateral bracket). This helped drive the root of the central incisor away from the implant drilling side to avoid any root damage by mistake. The arches used to treat that case were all of the wide arch design to help broaden the smile and adjust the buccal corridors sizes. Regarding the main arch dentition, leveling was commenced using NiTi archwires in sequential order, starting from the small rounded wires and gradually reaching the large rectangular wires. Auxiliary archwires (three-dimensional retraction loops including 1<sup>st</sup>, 2<sup>nd</sup>, and 3<sup>rd</sup> order bend) of 0.016 by 0.022 TMA materials were constructed in vertical looped with helix design. These wires were the main lever arm to drive the first premolars toward the midline to allow a path for the canines to move mesially. Later on, the auxiliary wires were used to bring the canines mesially and drive them occlusally while controlling the angulation at the same time. After the canines had reached their proper locations, the auxiliary wires were used again to drive the premolars buccally into correct alignment in the arch.

After the canines were ready to be settled vertically into position, the clever use of piggyback mechanics with 14 NiTi accessory archwire on top of the heavy main archwires were implemented. The piggyback mechanics had the ability to settle teeth beautifully while avoiding any unwanted distortion in the main arches for the well-aligned teeth. Auxiliary torqueing springs of 0.014 St-St wires were applied to the canines to precisely coordinate their inclination angles. Vertical extrusive mechanics are asymmetrically applied to the incisors by the use of light 5/16 elastics to close the open bite and correct the occlusal canting. The incisors in their proper positions were held together by lacing figures of eight ligatures to avoid spacing or flaring. Open coil spring of NiTi material was used to control the space of the missing lateral incisor for future implant placement. While reaching the larger archwires, light power chain elastics were used to close the spaces in the lower arch gradually and precisely.

By reaching the final stages of treatment, the implantologist applied the implant fixture in the bone together with some artificial bone augmentation and provisional crown to facilitate final finishing and adjustments of the rest of the dentition in accordance with the prosthetic view.

Finishing and detailing were provided through the use of 0.016 by 0.022 TMA archwires, wide dimensions, and light power chain elastic on top to correct any minor errors, close any residual spaces, and further torquing the roots of the incisors labially. TADs removed on both sides, and the gingiva was allowed to heal. On the day of debonding, scaling, polishing, were performed and fixed retainers were installed in both arches for stability.

Removal of the orthodontic appliance, together with some cleaning and esthetic fillings/recontouring of the lower canine to simulate lateral incisors, were provided.

The final impression for the permanent crown was performed on the same day of debonding with clear instructions for the laboratory to deliver the crown on the very next day. On the next day of debonding, the final restoration was obtained from the laboratory, tried in, and cemented in place. Double-alginate impressions were performed for both arches to fabricate double-vacuum retainers. Instructions to the laboratory were provided to apply wax relief on top of the permanent crown to avoid dislodgements and to keep the palatal coverage of the maxillary retainer to help prevent relapse of expanded arches. Instructions and final records were obtained on the day of delivery of the vacuum retainers to the patient, wishing her a continuous happy smile [Figure 5].

## RESULTS

The clinician was able to fully correct the upper canine's transposition and restore the missing lateral incisor without any damage to the periodontium. The arches achieved Class I incisors, canines, molars together with correction of incisors inclination and interincisal angle. The smile esthetics were improved, and the patient's chief complaints were fulfilled [Figure 2]. Cephalometric superimposition [Figure 3]. Three years follow-up had shown stable results [Figure 4].

## DISCUSSION

The envelope of discrepancy and the old protocols advising about teeth movement was implemented many years ago. Those guidelines were very critical to follow and helped

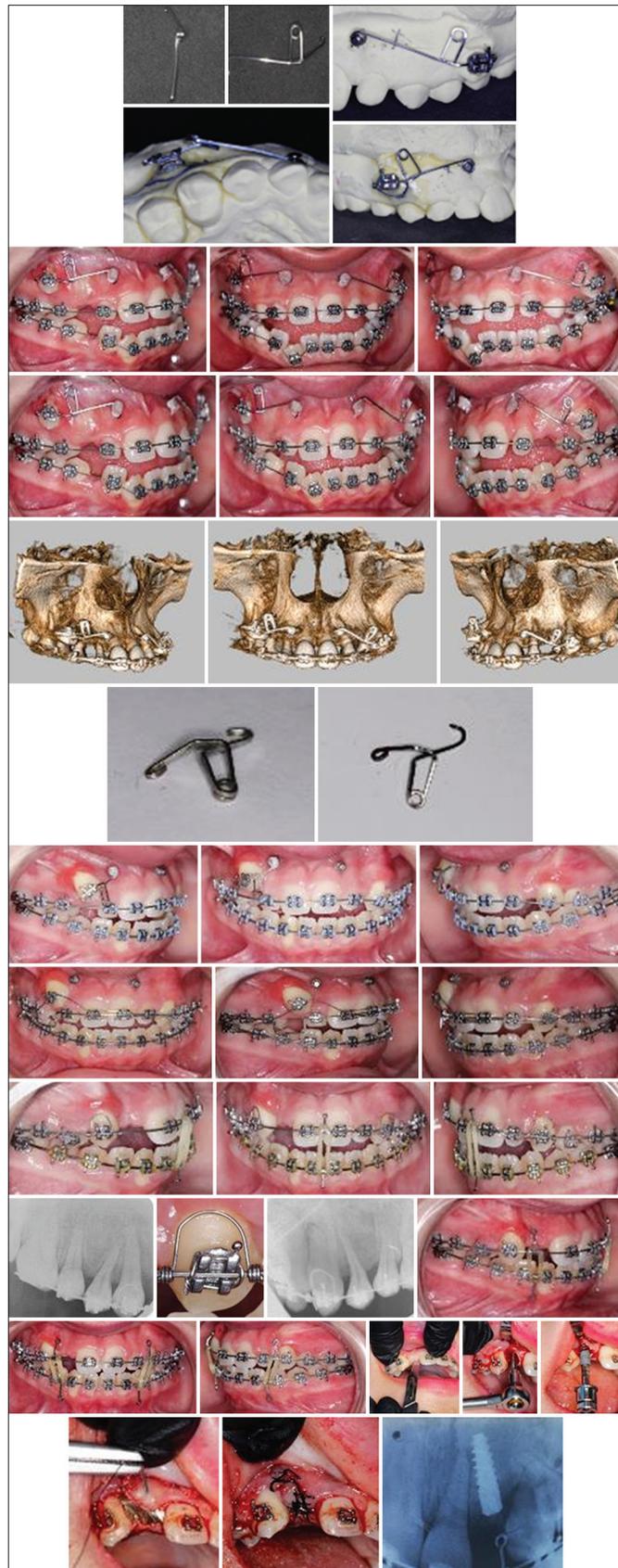


Figure 5: Show treatment mechanism and progressing including three-dimensional retraction loops construction on temporary anchorage devices and implant process confirmed with preapical and cone-beam computed tomography radiograph

avoiding the clinician and the patient's many stressful situations.<sup>[12,13]</sup> The guidelines were provided through intensive research and feedback from expert clinicians and formulated accordingly. Later on, the hierarchy of evidence was implemented, and the importance of high-quality evidence was introduced. Many of the dogmas we used to believe in in the past were eliminated. New protocols and modalities were enforced.<sup>[14-16]</sup> Two main issues are complicating the course of the classical way of thinking. The first problem is that new modalities, appliances, techniques, and clinicians with ideas are appearing with every sunrise. The second main obstacle was that high-quality research with meta-analyses or multicenter arranged trials was always very slow to compete with the everyday pioneer ideas.<sup>[17-20]</sup> In this case report, we presented a new modality to solve transpositions that did not fit the old protocol of avoiding the correction attempts. The beautiful result is evident, and the need for further prospective studies was needed to help to update the envelope of discrepancy. The beauty of orthodontics was in setting treatment rules then breaking those rules with the help of combined contemporary techniques and clever clinicians.

## CONCLUSION

Correction of maxillary transposition without biological damage was feasible by the use of TADs, careful mechanics, and clever planning of skillful clinicians. The mandibular transpositions were still very dangerous to correct, and it was better to accept and reshape. The old protocols and the classical envelop of discrepancy needed to be updated, although they were excellent for use with the old mechanics.

## Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given her consent for her images and other clinical information to be reported in the journal. The patient understands that her name and initial will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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## Conflicts of interest

There are no conflicts of interest.

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