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Case Report

Dentistry Section

Creative use of Clear Aligners with Tongue Spikes for Open Bite Correction: A Case Report

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ABSTRACT

Anterior Open Bite (AOB) is a complex dental condition caused by a variety of factors, including genetics, environmental influences, and functional issues. Managing AOB presents considerable challenges due to the high likelihood of relapse, particularly in cases linked to tongue dysfunction. Accurate diagnosis and thorough treatment planning are essential, especially when addressing factors such as tongue posture, which impacts speech, swallowing, and chewing. Achieving and maintaining an ideal overbite is particularly challenging, making it one of the most difficult aspects of orthodontic treatment. This case report demonstrates the effectiveness of using clear aligners with sharpened tongue spurs to address orthodontic relapse, misalignment, and AOB in an adult female patient. The application of a mandibular clear aligner combined with a tongue spike successfully treated the AOB caused by the patient's tongue rest posture, leading to improved aesthetics, function, and patient satisfaction. The patient's compliance with the aligner and adherence to proper tongue posture were crucial, similar to the requirements when using Temporary Anchorage Devices (TADs), multiloop archwires, and vertical elastics. Strict adherence to the clear aligner regimen was essential for achieving favourable results. Additionally, while it is generally recommended to consult with a myofunctional therapist before and during orthodontic treatment, in this case, the patient did not attend any such consultations. By combining functional effectiveness with a minimally invasive, aesthetic, and patient-centred approach, this method provides a valuable option for managing AOB associated with abnormal tongue posture. The results from this case highlight the potential for integrating innovative techniques into clear aligner therapy to achieve optimal outcomes in adult orthodontic treatments.

Keywords: Anterior open bite, Malocclusion, Relapse, Tongue spurs, Tongue thrust

CASE REPORT

A 31-year-old patient presented to the orthodontics department with the complaint of "rotated, misaligned teeth" and uneven spaces between the maxillary and mandibular anterior teeth. She had previously undergone orthodontic treatment 15 years ago. The patient had limited recollection concerning the reasons for requiring treatment during her first orthodontic intervention. Her parents took her to the orthodontist who diagnosed the necessity for treatment. She "thinks" she already had an open bite at that time.

During the anamnesis, the patient did not provide enough information to determine whether the open bite was primary or secondary. She reported no history of prolonged thumb sucking or pacifier use, nor recurrent tonsillitis or tonsil infections. The initial examination revealed hypoglossia, with the tongue "resting" between the upper and lower teeth, accompanied by some sigmatism. The patient had not consulted with a speech therapist.

The intraoral examination revealed a Class I malocclusion with anterior crowding and misalignment in both the maxillary and mandibular arches, as well as an Anterior Open Bite (AOB) of 5.0 mm. The patient exhibited tongue thrusting during swallowing, with the tongue also positioned in the anterior region at rest. There was a slight buccal inclination of tooth 21 of about 11 degrees, with teeth 12 and 22 showing crown rotations. Tooth 44 was buccally inclined, tooth 41 was in lingual inclination, tooth 32 exhibited rotation, and the patient had a high incisal exposure line [Table/Fig-1].

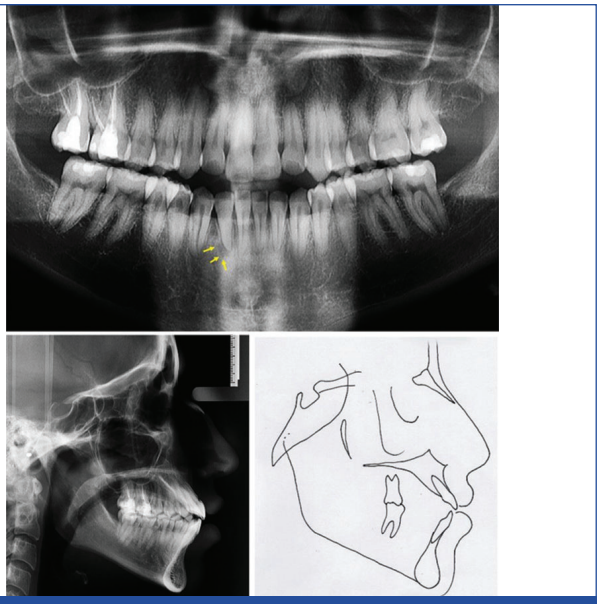
The panoramic radiograph showed the absence of third molars, and a periapical lesion was located at the apex of the mandibular right lateral incisor. All other teeth were normal in terms of size, shape, roots, and crowns. Cephalometric analysis revealed a tendency towards skeletal Class II (ANB=5°), increased vertical angles, and a convex profile (Z-angle=69°), with the absence of lip sealing. An

[Table/Fig-1]: Initial facial and intraoral images.

FMA value above 25 degrees generally indicates a predominance of vertical growth rather than sagittal growth [Table/Fig-2,3].

Despite the patient's dolichofacial characteristics, the AOB was not attributed to a steep mandibular plane or vertical growth pattern. Instead, it was primarily caused by an improper tongue posture habit. The posterior intercuspation was excellent, further supporting that the aetiology of the AOB was functional rather than skeletal [Table/Fig-2].

An increased Y-axis angle, with values greater than 66 degrees, is indicative of a vertical growth pattern often linked to open bites and long face syndrome. The three vertical measurements—FMA, SN-GoGn, and Y-axis—essentially provide the same diagnostic



[Table/Fig-2]: Initial panoramic, cephalometric radiograph, and tracing.

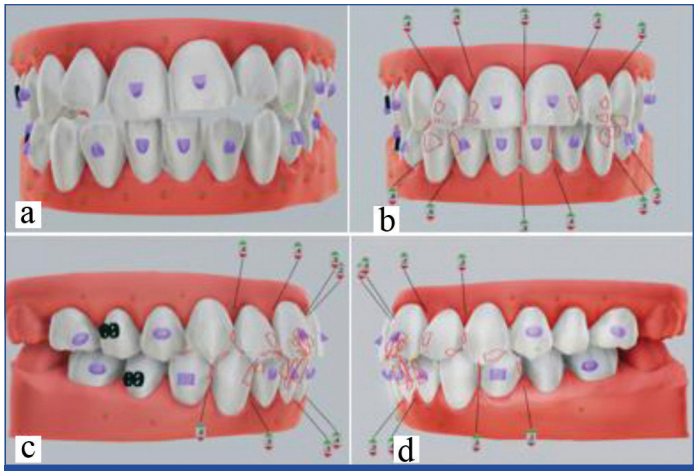
information [Table/Fig-2]. Both measurements, 1-NB (10 mm, 36°) and IMPA (96°), suggest proclined lower incisors. In the final measurements, the lower incisors were uprighted due to lingual crown movement or inclination, achieved through Interproximal Reduction (IPR) [Table/Fig-3].

Measurements	Initial	Follow-up
SNA (°)	85	86
SNB (°)	80	81
ANB (°)	5	5
Facial angle (°)	91	92
Convexity (°)	13	13
FMA (°)	30	30
SN-GoGn (°)	40	38
Y-axis (°)	59	58
1-NA (mm)	6	4
1.NA (°)	28	20
1-NB (mm)	10	1
1.NB (°)	36	34
IMPA (°)	96	90
Z-angle (°)	69	73

[Table/Fig-3]: Cephalometric measurements at the baseline and at 23 months follow-up.

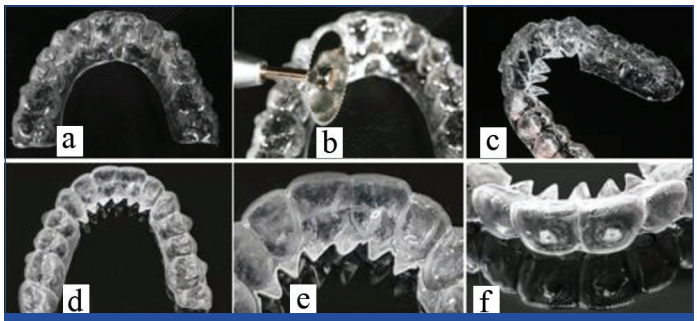
The upper incisor exposure line, combined with a mild vertical growth tendency, could suggest an alternative therapeutic approach, such as using Temporary Anchorage Devices (TADs) for posterior intrusion and counterclockwise rotation of the mandible to close the open bite. However, a less complex approach was chosen. The primary goal of the treatment was to address the patient's wish to close the AOB using a non-invasive approach, avoiding the use of traditional fixed appliances while ensuring an effective and aesthetically pleasing solution.

The chosen approach utilised aligners with Interproximal Reduction (IPR). There were 30 aligners in total. IPR was performed using a 0.25 mm diamond disc mounted on a straight handpiece, following the digital treatment plan, except for the interproximal space between the mandibular right canine and first bicuspid, where a 0.5 mm reduction was performed. All reductions were carried out at the beginning of the treatment. During refinements, any residual IPR was performed using abrasive strips. The decision was made not to complete the full extent of the suggested IPRs, acknowledging that this may have led to a less pronounced correction of the bimaxillary protrusion and open bite [Table/Fig-4].



[Table/Fig-4]: Digital set-up: a) The initial case in the software with pre-selected attachments; b) Frontal view of the virtual set-up showing final objectives and planned Interproximal Reductions (IPRs); c,d) Right and left lateral views detailing specified IPRs.

For the in-office aligners, during the digital setup, the teeth were adjusted to positions deemed appropriate from both functional and aesthetic perspectives. During the treatment, the aligners were constructed with palatal spikes, and intercuspation elastics were used, supported by aesthetic buttons bonded directly to the teeth [Table/Fig-5].



[Table/Fig-5]: Lingual spikes in all aligners and the retainer using a cutting disc with incisal bent using 442 pliers for optimal tongue control.

In the lower arch, there was no negative model discrepancy, so all performed IPR was utilised for the lingual movement of the incisor crowns. This movement was optimised by the use of medium 3/16 elastics, anchored on buttons bonded to the lower canines and on cutouts in the upper aligners in the region between the upper premolars [Table/Fig-6]. The direction of the elastic not only assisted in the uprighting of the lower incisors but also improved the intercuspation between the upper and lower premolars, which initially had an incipient Class III relationship.

[Table/Fig-6]: Intraoral progress photographs. Medium 3/16 elastics used, extending from the buttons on the lower canines to cutouts made on the aligners.

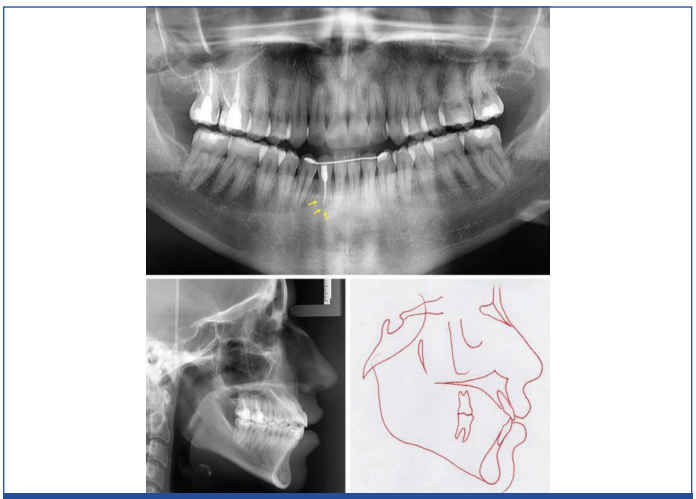
As the patient did not pursue consultation with a physiotherapist, she was instructed to perform conscious exercises for lingual myofunctional therapy, such as sliding the tip of the tongue from the incisive papilla towards the soft palate and laterally massaging the cheeks with the tip of the tongue. Instructions were also given to

"rest" the tip of the tongue in the area of the incisive papilla, with the dorsum of the tongue touching the roof of the mouth.

After 23 months, when the treatment successfully achieved the proposed objectives, a mandibular fixed retainer with a 0.7 mm stainless steel wire was bonded to the canines, and a 1 mm acetate removable retainer with integrated spikes was provided for the maxillary arch. The patient was instructed to wear the retainer full-time for six months, removing it only during meals, and then transitioning to nighttime use thereafter. A follow-up evaluation after 23 months post-treatment demonstrated stable results and a high level of patient satisfaction with her smile [Table/Fig-7].

[Table/Fig-7]: Facial and intraoral photographs at 23-month follow-up.

The final panoramic radiograph confirmed satisfactory root parallelism [Table/Fig-8], and cephalometric analysis showed notable dentoalveolar changes, particularly in the mandibular incisors, with an angle of 1-NB=34° and IMPA=90°, reflecting significant improvements in the patient's dental and facial aesthetics [Table/Fig-3].



[Table/Fig-8]: Panoramic, cephalometric radiograph, and tracing at 23-month follow-up.

DISCUSSION

The AOB is one of the most challenging malocclusions to treat, primarily due to its high potential for relapse. One of the main contributing factors to AOB is improper tongue rest posture [1].

The retroclination of the anterior teeth suggested a posterosuperior repositioning of the tongue, which was influenced by the incorporation of tongue spikes into the aligner. The patient demonstrated a high level of compliance with this modification throughout the treatment. Traditional treatment modalities for AOB in adults—such as molar intrusion, incisor extrusion using vertical elastics, multiloop edgewise archwires, TADs or orthognathic surgery—are often invasive and associated with significant complexity and patient discomfort [2].

The uniqueness of this case lies in the innovative approach to addressing moderate AOB in an adult by creatively modifying anterior tongue rest posture through the integration of tongue spurs into a clear aligner. This methodology distinguishes itself from conventional techniques that often utilise attachments with metal spurs in the maxillary and mandibular arches or a mandibular lingual arch with spurs to correct the abnormal tongue posture identified as the primary aetiological factor [3,4]. Follow-up cephalometric analyses indicated substantial improvements in both facial aesthetics and function, including the uprighting of mandibular incisors, incisor extrusion, and molar intrusion, all achieved without altering the posterior dentition.

Clear aligners have emerged as a preferred modality in adult orthodontics due to their aesthetic appeal, comfort, and ease of maintenance, which significantly enhance patient adherence and satisfaction in comparison to traditional fixed appliances [5,6]. Unlike cases that solely use aligners [7], in this case, the integration of lingual spurs within "in-office" aligners proved effective in controlling tongue posture and preventing relapse. The patient must adhere strictly to the clear aligner regimen to obtain optimal results. Furthermore, consultation with a myofunctional therapist is advised before and throughout the orthodontic treatment; however, this particular patient did not attend any such consultations.

In a case presented by Antelo OM et al., a growing patient exhibiting a hyper-divergent growth pattern and AOB underwent treatment using a non-extraction approach with fixed appliances and TADs for vertical control, in conjunction with bonded tongue spurs for tongue function re-education. The stability of the results was confirmed during a 1-year follow-up, attributable to the use of tongue spurs [8]. In another case, a growing patient presenting with Angle Class III malocclusion, excessive lower facial height, and AOB was successfully treated with a multiloop edgewise archwire and a chin cup [9].

Although the combination of orthodontic treatment with surgical intervention is often warranted for skeletal AOB, the preferences of the patient remain of utmost importance. The appliance yielded favourable and stable outcomes, though it demands exceptional professional skill. By merging functional efficacy with a minimally invasive, aesthetic, and patient-centred solution, this approach offers a valuable option for managing AOB associated with tongue posture abnormalities. The outcomes achieved in this case underscore the potential for integrating innovative techniques into clear aligner therapy to realise optimal results in adult orthodontic treatment.

Achieving an ideal overbite is inherently complex, and ensuring its stability remains one of the most intricate aspects of orthodontic treatment. In the case under consideration, the patient had previously undergone orthodontic treatment utilising a fixed appliance, seeking further intervention primarily to correct rotated and misaligned teeth, in addition to addressing uneven spaces between the maxillary and mandibular anterior teeth. The initial requirement expressed by the patient was to utilise clear aligners for these corrections. By combining functional efficacy with a minimally invasive, aesthetic, and patient-centred solution, this method offers a valuable option for managing AOB associated with tongue posture abnormalities.

CONCLUSION(S)

The AOB caused by tongue rest posture can be effectively treated with a mandibular clear aligner featuring a tongue spike, achieving improved aesthetics and function, along with high patient satisfaction. The results obtained in this case demonstrate the potential of integrating innovative techniques into clear aligner therapy to deliver optimal outcomes in adult orthodontic treatment.

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