Case Report   **Dental Medicine**

Orthodontic Management of Deep Bite with Aligners: A Case Report and Review of the Literature

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Abstract

The primary motivation for individuals with deep-bite malocclusion seeking orthodontic treatment is the improvement of aesthetics, occlusion, and functions. Deep bites can be treated by the intrusion of anterior teeth and the extrusion of the posterior teeth, or both, according to the exposure of the incisors in the smile. In this case report, we present the treatment of a female patient with a deep-bite malocclusion. This paper describes the clinical and radiographic changes with orthodontic treatment using Invisalign clear aligners and their effectiveness to normalize the overjet and overbite and enhance both aesthetics and functions.
Keywords: Skeletal Class I, Deep-Bite Malocclusion, Orthodontic Treatment, Clear Aligners.

INTRODUCTION

A deep bite is defined by an excessive vertical overlap of the mandibular incisors by the maxillary incisors during maximum intercuspation. This malocclusion trait can be of dental, skeletal, or mixed origin [1]. Typically, a deep bite is associated with retroclination and extrusion of the anterior teeth in both arches, a reduction in posterior vertical dimension, or a combination of these factors. In cases of skeletal deep bite, there is often a counterclockwise mandibular rotation [2].

The primary goal of orthodontic treatment for deep bite correction is to level the curve of Spee, which may involve intrusion of the maxillary and/or mandibular anterior teeth, extrusion of the posterior teeth, or a combination of both approaches. Treatment planning should consider the optimal approach based on the degree of maxillary incisor exposure during smiling. Specifically, for patients with a deep bite accompanied by a gingival smile, intrusion of the maxillary incisors is advisable. Conversely, in patients with adequate maxillary incisor display and a deep bite, greater intrusion of the mandibular incisors and extrusion of the posterior teeth are typically recommended [3].

The advancement of orthodontic treatments utilizing clear aligners has led clinicians to closely examine their effectiveness and efficiency [4–13]. Over the years, multiple companies have entered the orthodontic aligner market, with Invisalign emerging as the industry leader in patient volume, provider network, and technological innovation. This dominance has also contributed to an increase in related scientific literature.

The aim of this paper is to present a clinical case of deep bite treatment and to assess the effectiveness of aligners in correcting overbite, exploring their capabilities and limitations, as well as their therapeutic precision.

PRESENTATION OF THE CASE

Clinical Examination and Diagnosis:
A female patient aged 23 years consulted with the Dento-Facial Orthopedics Department at the dental

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medicine clinic of Monastir, Faculty of Dental Medicine, University of Monastir. Her demands were both esthetical and functional. She had a chief complaint of her deep-bite. No systemic or medical abnormalities were described.

The extraoral examination showed from the frontal view a symmetrical face with a parallelism at the horizontal lines of the face and a straight medial sagittal plane. When smiling, the gummy smile is clear (Figure 1a and 1c).

The profile analysis showed a convex profile, a well-positioned upper lip and lower lip, and a labio-mental fold in allonged S shape (Figure 1b).

The intraoral examination showed a satisfactory oral hygiene. The upper dental arch was U shaped with a mild crowding in the incisal area. The lower dental arch was U shape, also exhibited a mild crowding in the incisal area (Figure 1g and 1h).

Moreover, the occlusal examination revealed a bilateral molar Angle class I and a canine Angle Class II. Both the upper and lower incisors were reclined and the mandibular midline was deviated 1 mm towards the right of the midsagittal plane. The overjet was irregular from 1 to 2 mm with a deep-bite reaching 6 mm in the anterior region (Figure 1d, 1e and 1f).

Furthermore, no symptoms or signs of any temporo-mandibular joint (TMJ) disorder were observed, maximal opening and lateral and anterior movements were within normal limits.

The functional examination revealed a mixed ventilation with nasal breathing predominance, a functional swallowing and a normal phonation.

The panoramic radiograph showed that all teeth were present except three third molars (two lower and one upper right). There were no supernumerary teeth. The crown-root ratios were normal with good alveolar bone levels, no bone pathology and no root resorption. In addition, the mandibular condyles, nasal floor and maxillary sinuses appeared normal (Figure 2a).

The lateral cephalometric radiograph revealed a class I skeletal malocclusion (ANB = 3°) (AoBo = -1mm) with a slightly retrused maxillary position (SNA= 79°) and mandibular position (SNB = 76°) in relation to the anterior skull base. Additionally, a hyperdivergent vertical skeletal pattern was noted (GoGn/SN = 38° and FMA = 28°). Furthermore, the maxillary incisors presented a decrease in the axial inclination in relation to their alveolar base (I/F=93°), and the same situation for the mandibular incisors (IMPA=81°) (Figure 2b).
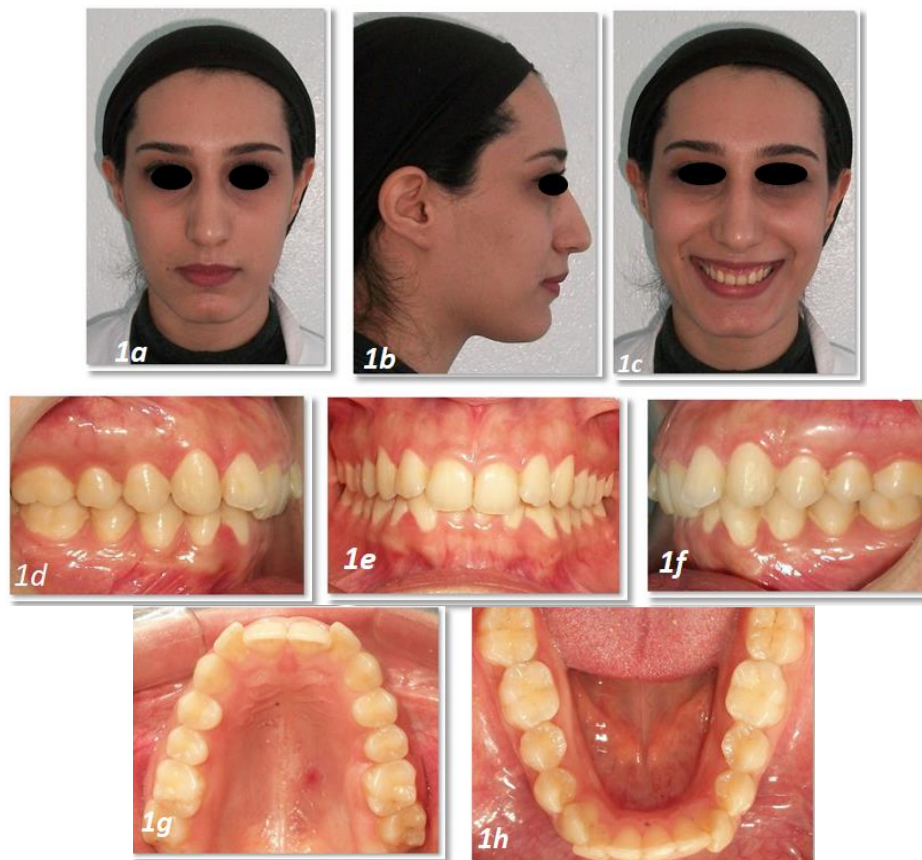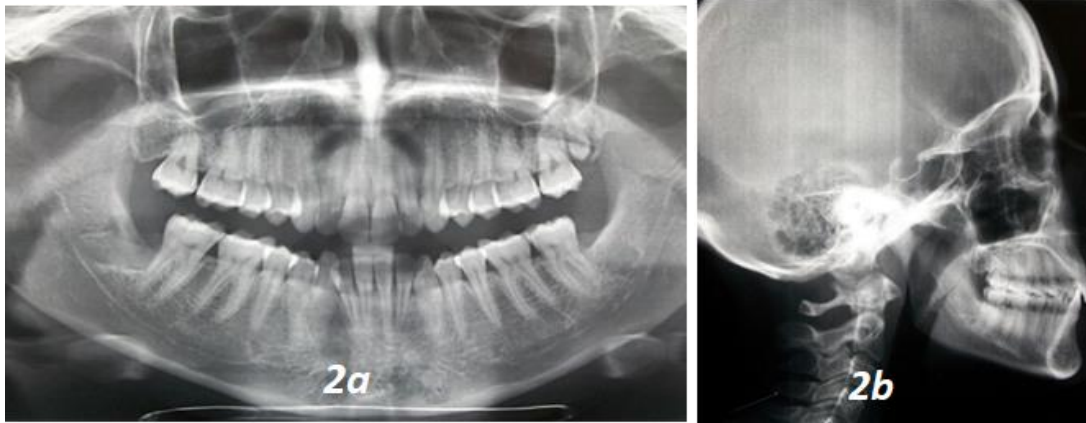

Figure 1(a-h): Pre-Treatment Photographs

Figure 2 (a-b): Pre-treatment radiographs

Treatment Goals:

The treatment goals for this patient were as follows: (1) To obtain pure nasal breathing. (2) To open the deep-bite. (3) To resolve the dental crowding in maxillary and mandibular arches. (4) To establish normal Class I canine and molar relationships with normal overjet and overbite. (5) To correct the inclination and position of the maxillary and mandibular anterior teeth. (6) To Improve facial esthetics and smile.

Treatment Alternative:

The chosen treatment was: an orthodontic treatment with clear aligners without premolars extraction and with stripping.

Treatment Progress:

After scanning the patient and approving the ClinCheck (Figure 3), clear aligners (Align Technology, Santa Clara, California) were delivered to the patient. Each aligner was worn at least 22h per day for 15 days.

The treatment included both a maxillary and mandibular arc expansion, a controlled intrusion and protrusion of both upper and lower anterior teeth and stripping (Figure 4).

Finally, after the active treatment phase, all appliances were removed, retention was performed with a bonded stainless steel lingual fixed retainer in both the maxillary and the mandibular arches and posttreatment records were taken (Figure 5).
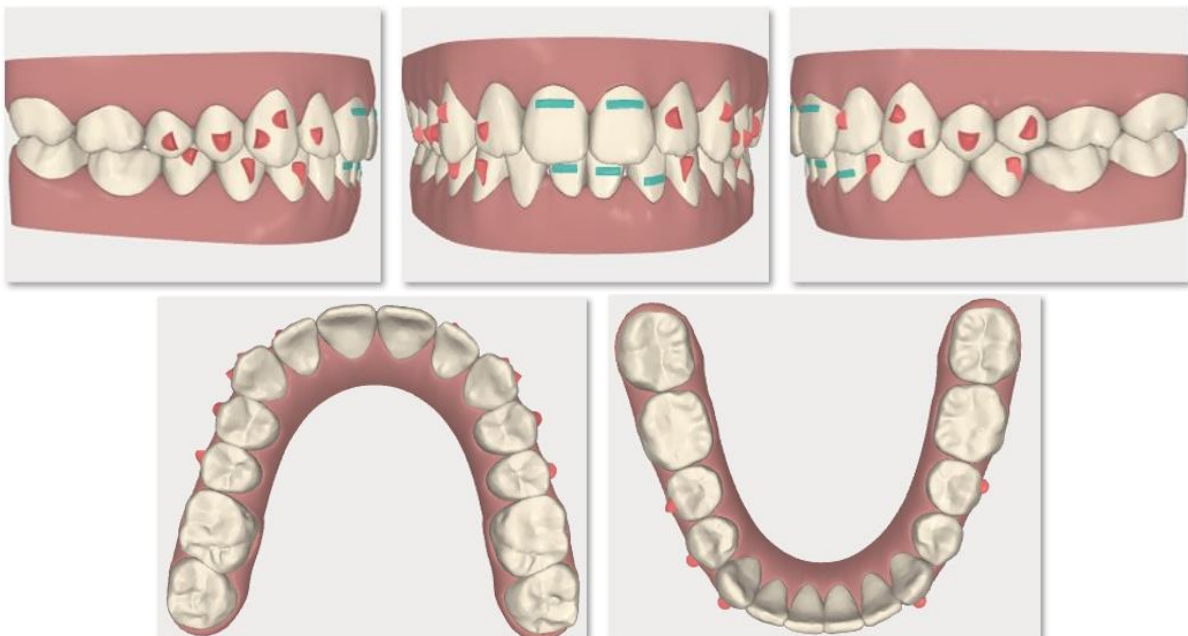

Figure 3: ClinCheck

Figure 4: Treatment in progress

Treatment Results:

All the predefined objectives were fulfilled: a significant improvement in the soft tissue profile indicated by the position of the upper lip, lower lip and the chin. The smile esthetics were significantly improved. (Figure 5 a-c) Intraorally, A class I bilateral angle canine and molar relation was achieved with good interdigitated occlusion, crowding was corrected, and an adequate Overjet and Overbite were achieved. The upper and lower dental midline coincidence was obtained (Figure 5 d-h). The post treatment cephalometric evaluation and superimposition confirmed a positive change in the profile (Figure 6). There was also a positive change in dentoalveolar measurements in both sagittal and vertical dimension (Table 1) (Figure 5j). Lastly, a panoramic radiograph shows satisfying root parallelism (Figure 5i).
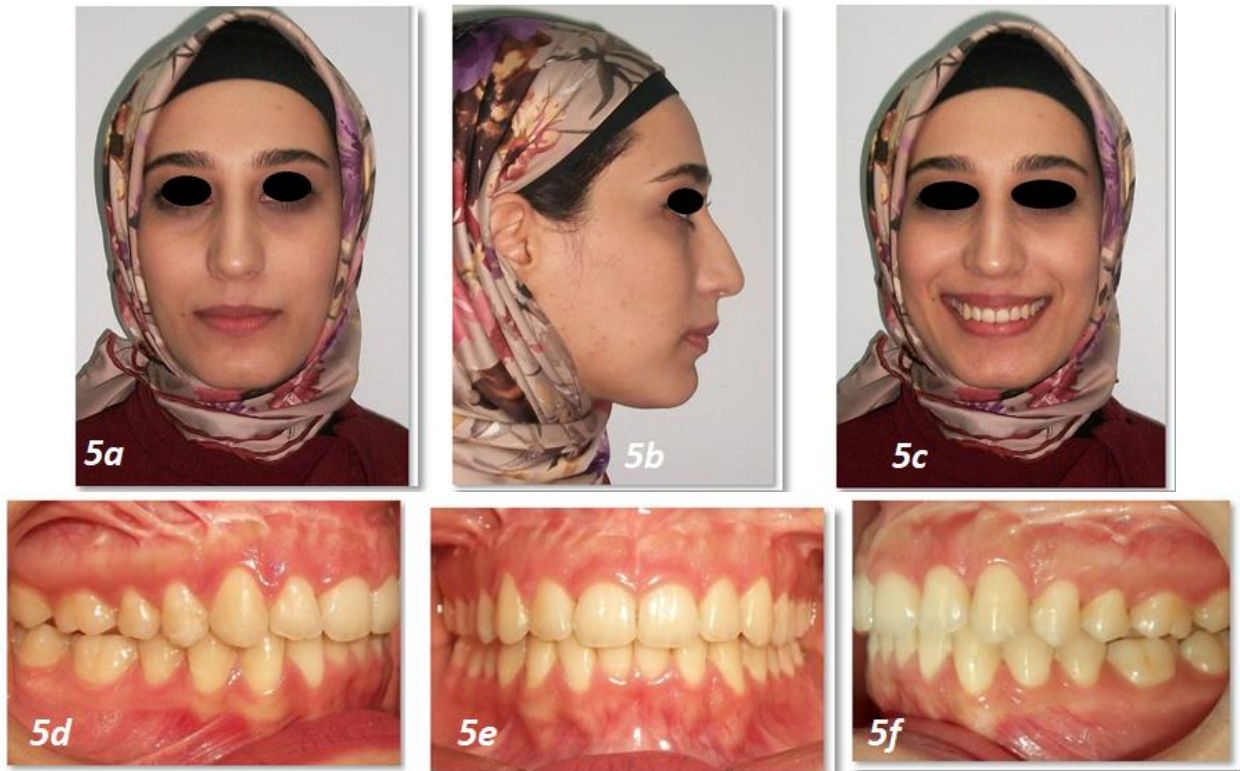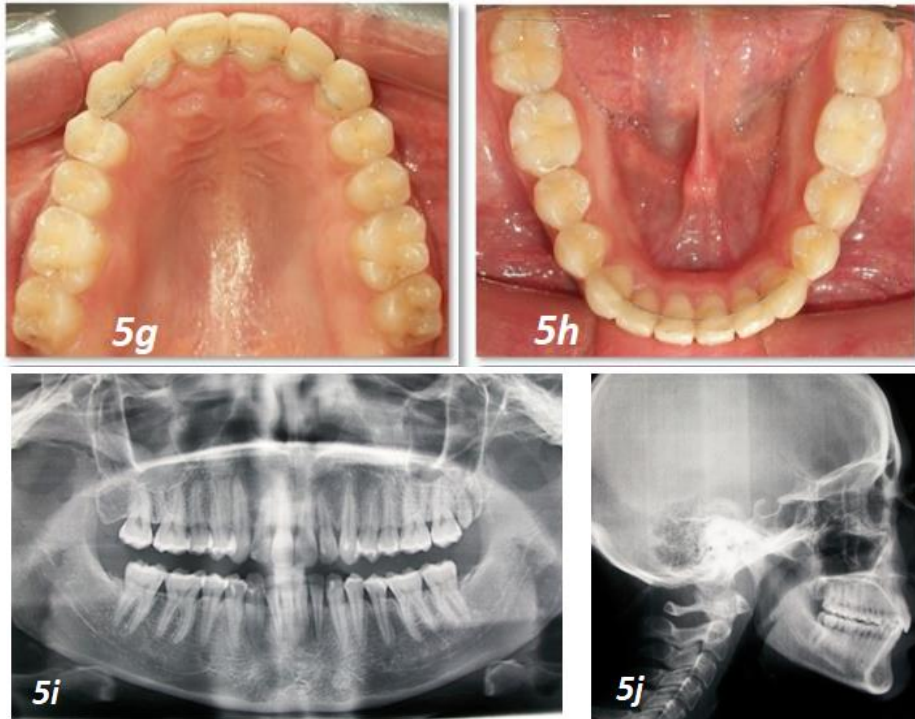
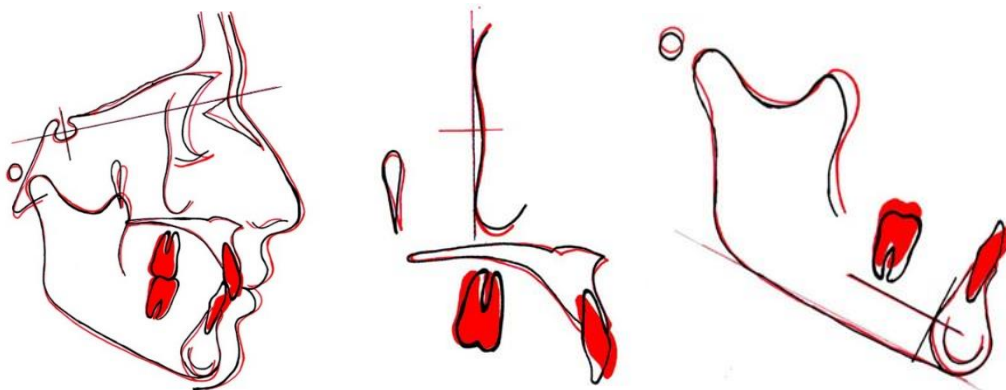**Figure 5 (a-j): Posttreatment photos and radiographs**

Figure 6: Total and partial cephalometric superimpositions: pretreatment (black) and posttreatment (red)

Table 1: Pretreatment, postmyofunctional, and posttreatment cephalometric data

Parameter	Average	Pre-treatment	Post-treatment
SNA (°)	82	79	79
SNB (°)	80	76	76
ANB (°)	2	3	3
AoBo (mm)	0	-1	1
FMA (°)	25	28	29
GoGn/Sn (°)	32	38	39
FMIA (°)	68	71	56
I/i (°)	135	157	130
I/F (°)	107	93	106
IMPA (°)	90	81	95

DISCUSSION

Most papers agree that a deep bite is difficult to treat with aligners, and anterior intrusion and posterior extrusion are difficult to achieve, but not all papers share the same opinion.

When analyzing the literature based on the systems studied, it is notable that the Invisalign® system is by far the most frequently discussed.

Regarding efficacy, Djeu (2005), in a comparison of OGS scores between Invisalign® and

fixed appliances, concluded that Invisalign® is inferior to fixed appliances for occlusal contacts, buccolingual inclination, and overbite. However, there was no significant difference in root control, proximal contacts, and alignment [4].

In 2013, Kassas *et al*., observed improvements in OGS scores after treatment in all categories except occlusal contacts and occlusal relationships. Notably, improvements were seen in alignment, buccolingual inclination, and the total OGS score [5].

Gu (2017) found no post-treatment differences in PAR scores between Invisalign® and fixed appliances, although fixed appliances were deemed more effective overall [6].

Papageorgiou (2019), in a meta-analysis comparing aligners and fixed appliances, noted that treatment outcomes were of lower quality with aligners. Five of the eight OGS score evaluation factors—buccolingual inclination, occlusal contacts, occlusal relationships, overbite, and root angulation—were inferior with aligners. However, the meta-analysis of PAR scores revealed no significant differences between aligners and fixed appliances, except for overjet and control of maxillary anterior teeth, which were better with aligners [7].

Palone *et al*., (2022) recommended incorporating an overcorrection of approximately 20% during the initial planning phase for challenging movements, such as tipping and rotation, to enhance the effectiveness of clear aligner therapy (CAT) [8].

The lack of consensus among study results can partly be attributed to the fact that many articles on the Invisalign® system do not account for newer technologies, particularly those introduced after the G5 generation. This divergence in findings is explained by the use of different tools, which are continuously evolving.

Regarding the predictability of movements involved in deep bite treatment, the literature also provides variable values due to studies being conducted with different generations of the Invisalign® system, and an improvement in general predictability over the years is evident: Kravitz (2009): 41% [9]; Drake (2012): 55% [10]; Simon (2012): 59.3% [11]; Chisari (2014): 57% [12]; Lombardo (2017):73.6% [13].

CONCLUSION

Deep-bite malocclusion is a great challenge for orthodontists: a detailed diagnosis with a rigorous analysis of the occlusal, skeletal and soft tissue components has to be performed. Also, a correct planning as well as an adequate execution of the treatment plan are determinant factors for a successful result and long-term stability. In the case described,

achieving planned treatment goals was challenging. The management of the deep-bite malocclusion was shown successfully. Indeed, good facial esthetics, functional and occlusal results were achieved.

Based on the results of the studies included, it is evident that aligners are an effective option for the treatment of deep bite. However, despite the promising and continuous improvement in outcomes over the years, aligners face limitations in managing complex deep bites. Studies show that aligners do not always achieve the planned dental movements satisfactorily, particularly at the root level. Although theoretically feasible, the results obtained often fall short of expectations and treatment plans. It is also important to consider that deep bite treatment occurs within a broader clinical context, as this malocclusion is rarely isolated.

To maximize the effectiveness of aligners, it is essential to have a thorough understanding of the biomechanical characteristics associated with this method. This includes the use of strategies such as overcorrections, mini-screws, Power Ridges, pressure points, optimized attachments, and bite ramps, among others.

In conclusion, aligner treatment can be a valid alternative to conventional orthodontic treatment. However, it does not appear to offer better results compared to fixed orthodontic appliances in adult patients.

Declaration of Patient Consent: The authors certify that they have obtained all appropriate patient consent.

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