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Mandibular molar distalization with clear aligners in Class III patients

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Key words *Class III malocclusion, Invisalign, mandibular molar distalization, non-growing patients*

Objective: To describe the use of clear aligners to achieve mandibular molar distalization in patients with molar Angle Class III relationship.

Materials and methods: Two patients, aged 31 and 23 years old, with molar Angle Class III relationship and canine Class III relationship are presented and discussed. The patients were non-growing patients, so treatment plans included the distalization of mandibular molars. Due to the aesthetic concerns, it was decided to correct the malocclusion only with clear aligners, without additional appliances.

Results: Although the patients were non-growing, distalization of mandibular molars was obtained and Angle molar and canine Class I relationships were achieved. The perception of facial profile improvement was very motivating for patients and it helped to reinforce treatment compliance.

Conclusions: The presentation of these case reports shows that the use of clear aligners was reliable in non-growing patients to correct canine and molar Class III relationships.

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Introduction

Class III malocclusion has long been considered a complicated maxillofacial disorder that is characterised by a concave profile, which may exhibit mandibular protrusion, maxillary retrusion or a combination of both, as well as possible anatomical heterogeneity of this malocclusion[1]. The prevalence of Class III malocclusion cases ranges from 0.48% to 4% among Caucasians[2], but it rises to 10% in the Japanese population, with the highest prevalence registered in China reaching 25% according to NHANES (National Health and Nutrition Examination Survey)[3,4]. Skeletal and dental components of Class III malocclusions are usually established since early childhood and may worsen with growth[5-10]. Concerning the treatment of such malocclusion, scientific literature has been focused mainly on orthopaedic treatment in growing patients[10,11]. Regarding non-growing patients, it is important to distinguish between skeletal Class III, for which a surgical approach could be the best choice, and dental Class III, when an orthodontic dental compensation without surgery could be achieved.

Fig 1a to h Case 1. Initial clinical records.

In recent years an increasing number of adult patients have sought orthodontic treatment, wishing for aesthetic and comfortable alternatives to fixed appliances[12,13]. In answer to this request the orthodontic system Invisalign (Align Technology, Santa Clara, CA, USA) was introduced. Nowadays Invisalign is reported to be efficient in solving malocclusions with effects comparable to fixed appliances[14].

Several case reports[15-17] showed the possibility of obtaining sequential molar distalization in non-growing patients by using the Invisalign system. This kind of treatment is commonly proposed in correction of Class II molar relationships for patients with minor skeletal discrepancies, and could be obtained with intraoral or extraoral forces, with or without skeletal anchorage.

Simon et al[18] demonstrated high predictability (88%) of maxillary molar distalization with aligners when the use of attachments and a mean movement of 2.6 mm was planned. Similar results were showed by Ravera et al[19] in a multicentre retrospective study, and by Garino et al[20].

The same principles adopted for maxillary molar distalization could be applied for mandibular molar distalization in the correction of Class III malocclusion with Invisalign. In the scientific literature, to the present authors' knowledge, there are no case reports and analysis of this type of treatment is lacking.

The aim of this work is to present two case reports of Class III malocclusions in non-growing patients solved through distalization of mandibular molars with Invisalign.

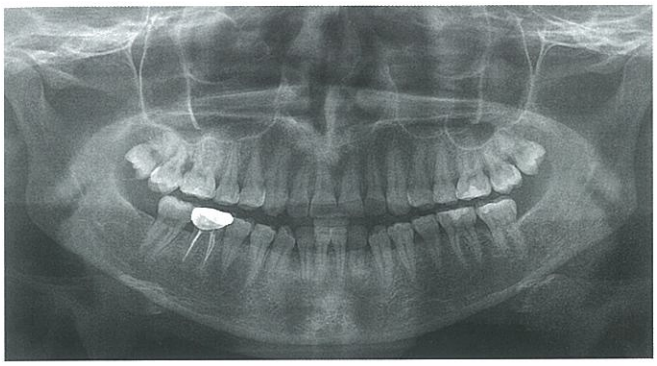

Fig 2 Case 1. Initial panoramic radiograph.

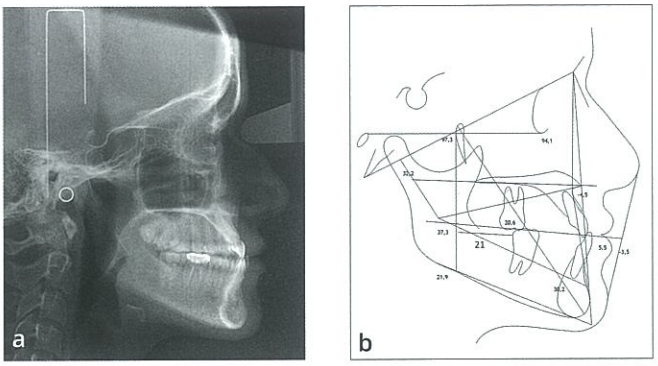

Fig 3a and b Case 1. Initial cephalogram.

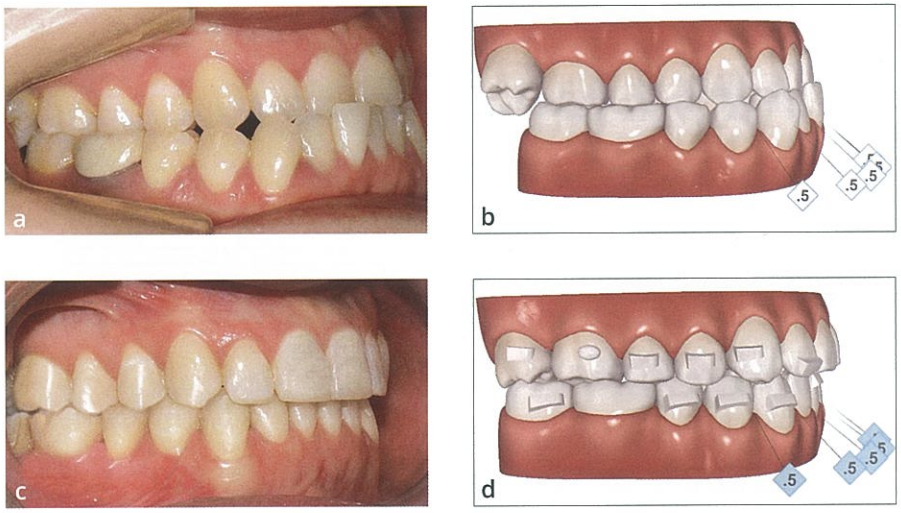

Fig 4a to d Case 1. Initial ClinCheck (a and b) compared with final ClinCheck (c and d) (sagittal view).

Case 1

A 31-year-old woman, without history of orthodontic or orthopaedic treatment, wanted to solve her malocclusion. Clinical examination revealed the presence of molar and canine Class III relationships, mandibular anterior crowding and anterior crossbite, and the incisal edges of the maxillary right central and lateral incisors (teeth 11 and 21) appeared worn out (Fig 1). The mandibular third molars (teeth 38 and 48) were absent, perhaps extracted in the past, but the maxillary third molars (teeth 18 and 28) were both overerupted, and it was decided to extract these teeth (Fig 2). Cephalometric analysis showed a skeletal Class III with a Ricketts facial convexity of −4.5 mm (Fig 3).

Following the patient's aesthetic requests, an Invisalign treatment was adopted. The appliance prescription was planned with expansion of maxillary arch, interproximal reduction (IPR) in the mandibular arch, sequential distalization of about 3 mm for the mandibular second molars (teeth 37 and 47), and the use of Class III elastics for 22 hours per day (together with the aligners).

To obtain a higher level of compliance, motivation from an aesthetic start to the treatment was requested, by solving anterior crowding with the first aligners. To solve malocclusion, 46 aligners were planned: aligners had to be changed every 2 weeks so the treatment period was approximately 23 months. At the end a refinement was requested, so the total treatment time was 29 months. The incisal edges of the maxillary right central and lateral incisors were reconstructed with composite. After the treatment, the mandibular right first molar (tooth 46) was extracted because of conservative problems, and replaced with an implant-retained crown (Figs 4 to 7).

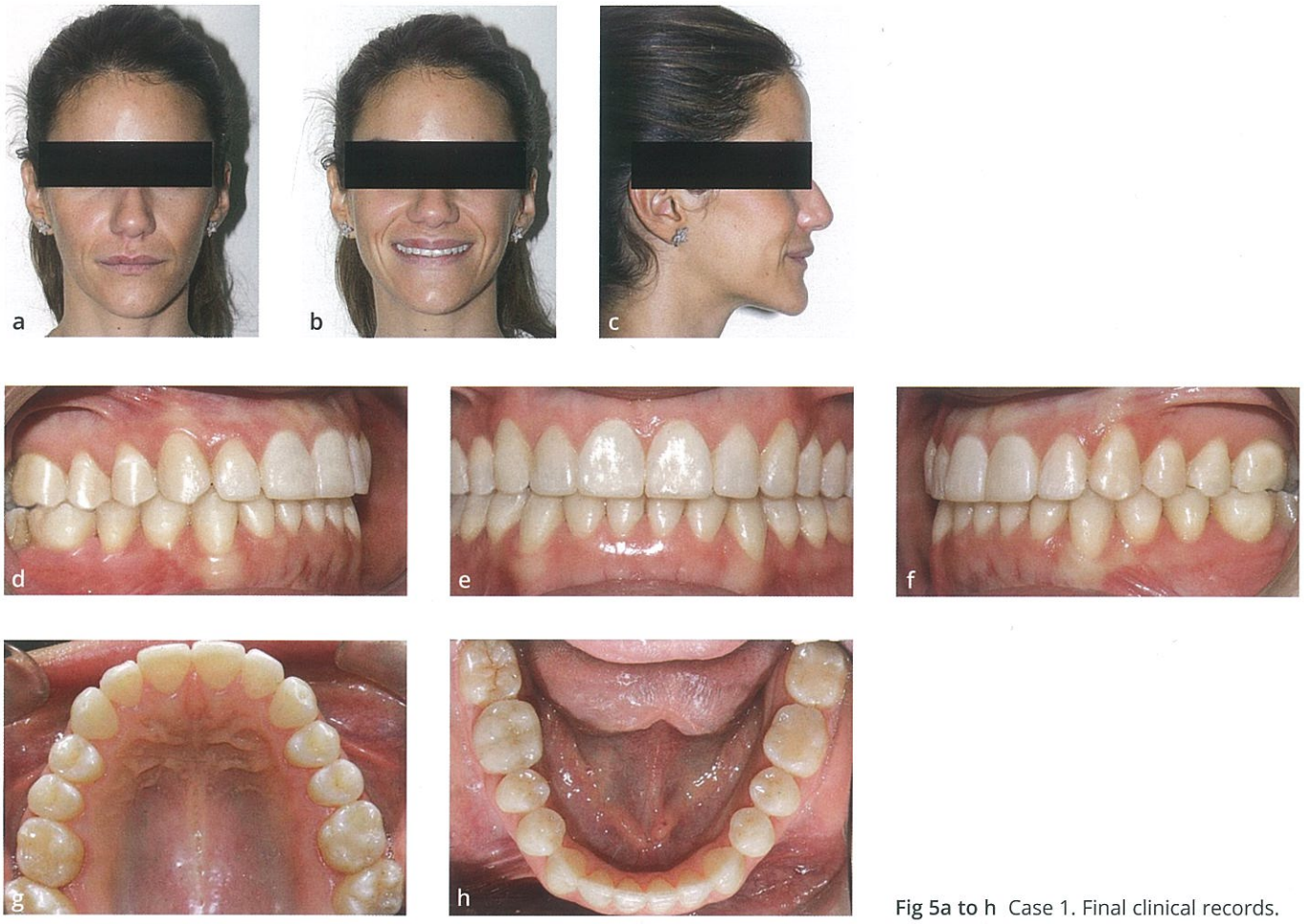

Fig 5a to h Case 1. Final clinical records.

Fig 6 Case 1. Final panoramic radiograph.

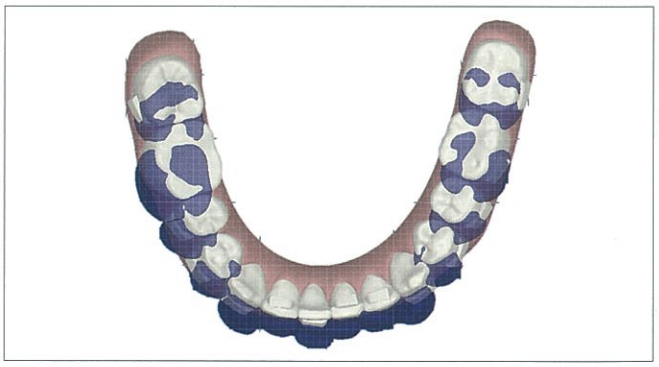

Fig 7 Case 1. Superimposition of initial ClinCheck with final ClinCheck (occlusal view).

Case 2

A 23-year-old man with a skeletal and dental Class III malocclusion presented. Clinical observation showed the presence of molar and canine Class III relationships, anterior crossbite only on the left side, with an overeruption of the maxillary left central incisor (tooth 21) (Fig 8). Cephalometric analysis revealed a skeletal Class III with a Ricketts facial convexity of −1.2 mm and McNamara mandible length of 139.65 mm (Fig 9). Invisalign treatment was planned, with

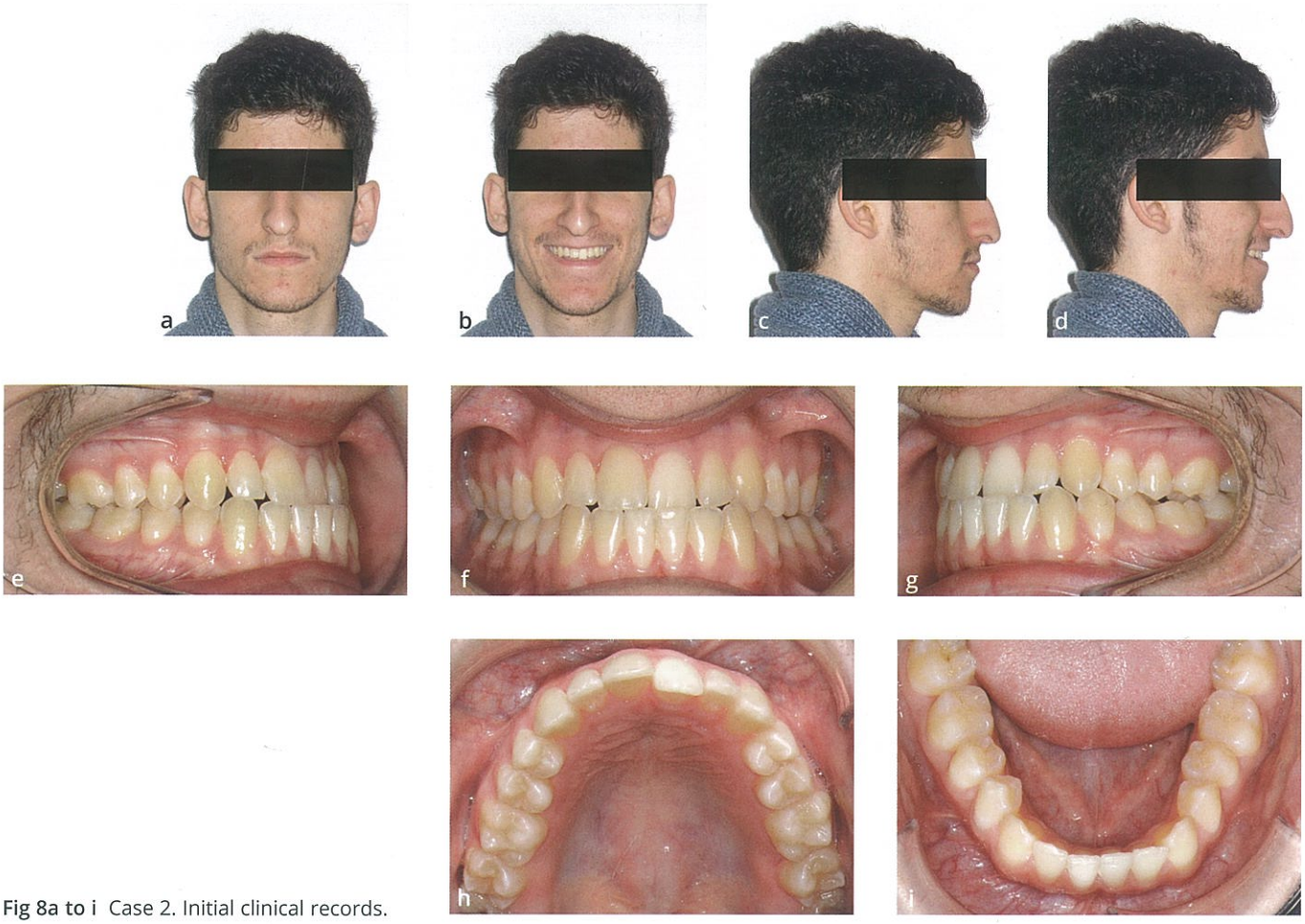

Fig 8a to i Case 2. Initial clinical records.

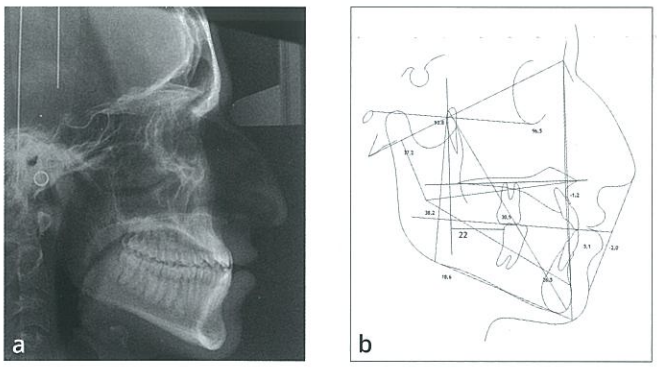

Fig 9a and b Case 2. Initial cephalogram.

Fig 10 Case 2. Initial panoramic radiograph.

expansion of the maxillary arch, IPR in the anterior mandible, sequential distalization of the mandibular second molars of 2.5 mm, and the use of Class III elastics for 22 hours per day (together with the aligners). Also in this case, in order to obtain a higher level of compliance an aesthetic start motivation was requested. In order to take advantage of the posterior empty spaces, the treatment started immediately after the extractions of the mandibular third molars (teeth 38 and 48) (Fig 10). The case ended with 50 aligners, without further refinement (Figs 11 to 16).

Fig 11a to e Case 2. 12-month intraoral records.

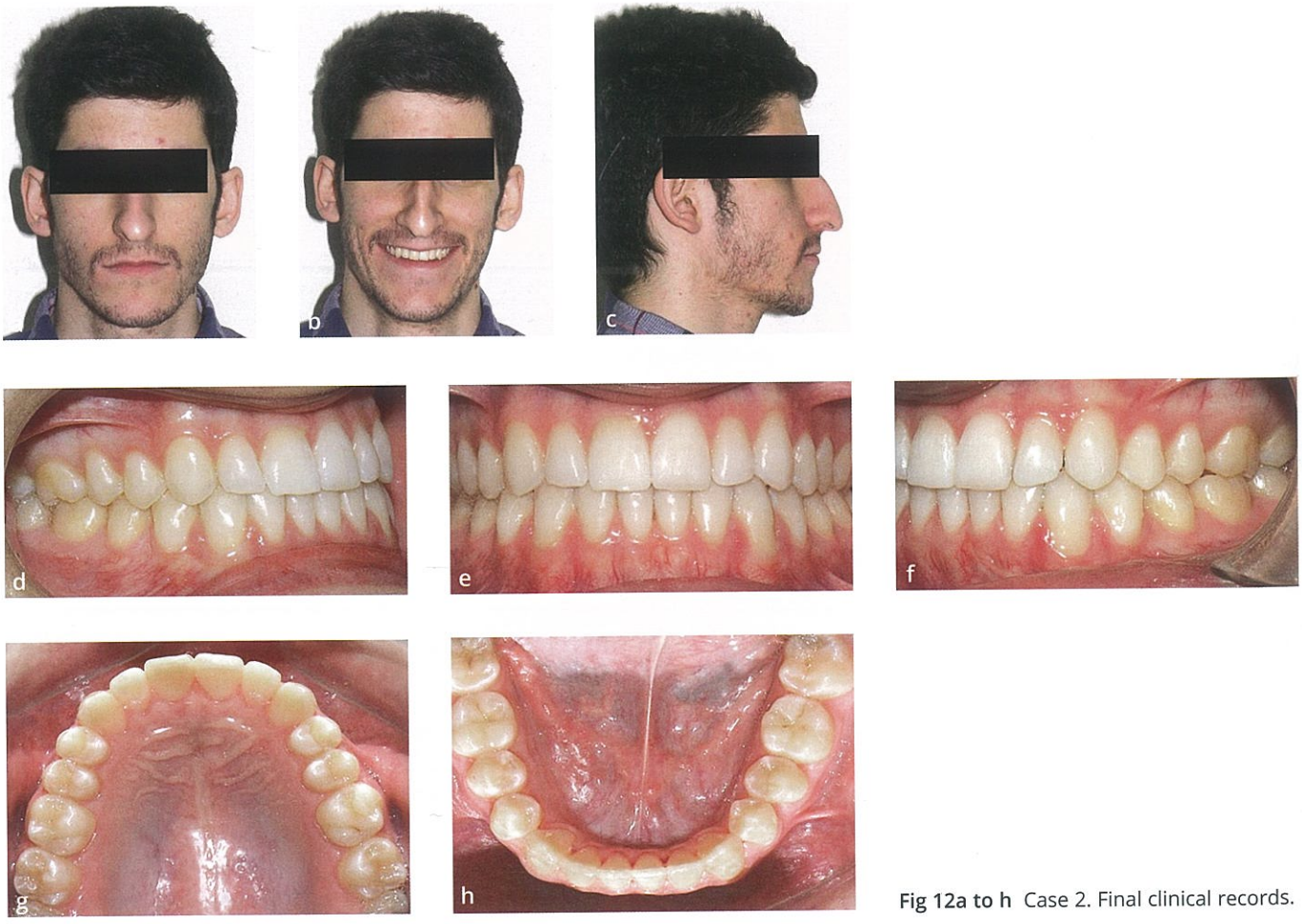

Fig 12a to h Case 2. Final clinical records.

Fig 13 Case 2. Final panoramic radiograph.

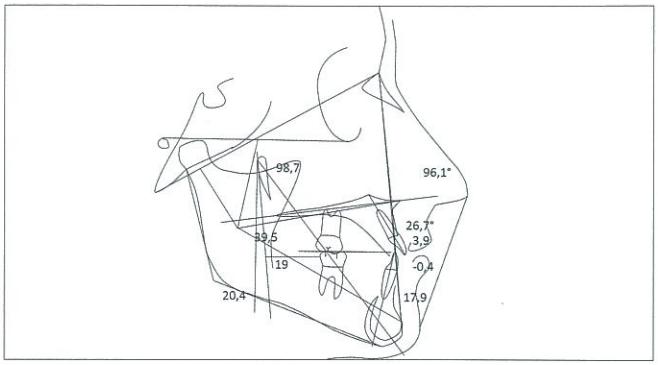

Fig 14 Case 2. Final cephalometric analysis.

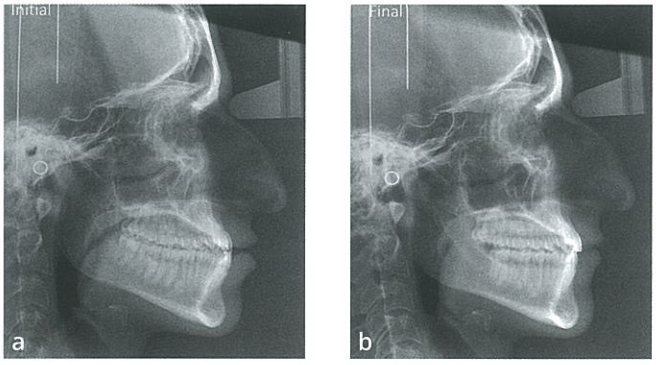

Fig 15a and b Case 2. Comparison of initial (a) and final (b) lateral radiographs.

Fig 16 Case 2. Superimposition of initial ClinCheck with final ClinCheck (occlusal view).

Discussion

The aim of this study was to present two cases of distalization of mandibular molars. Both cases resulted in a correction of molar and canine relationship from Class III to Class I, with only the use of Invisalign appliance. In the scientific literature there are no similar studies, but it is possible to follow the same principles of maxillary molars distalization in order to obtain mandibular molars distalization.

As assessed by a recent study by Ravera et al[19], a maxillary molars distalization up to 2 to 3 mm of the limit can be planned. Aligners seem to be effective in preventing distal tipping and molar extrusion during distalization. Simon et al[21] showed that forces and moments generated by Invisalign during distalization are coherent with literature values: initial mean forces were about 1.0 N when an attachment was associated. Another study conducted by Simon et al[18] reported an accuracy of 87% when a distalization of 3 mm was requested with clear aligners. In a recent review, Rossini et al[14] stated that Invisalign is effective in controlling maxillary molar bodily movement when a distalization of 1.5 mm has been prescribed.

The amount of distal movement on mandibular molars obtained in this study was comparable with those expressed in studies performed on the maxillary arch. In the cases presented, a sequential distalization of mandibular molars of about 3 mm for Case 1 and 2.5 mm for Case 2 was planned.

This distance was measured from the distal point of the mandibular molar to Rickett's vertical line (the perpendicular line to the palatal plane passing to the pterygoid point) on cephalometric analysis and observed clinically.

In order to obtain this kind of movement, third molars should be extracted to provide enough space to move the second and first molars. Furthermore, considering that the correction comes primarily from tooth movement, more anchorage control is required[22]. Generally, when an intraoral distalizing force is applied, an anterior loss of an-

chorage was registered[23,24], due to the reciprocal force reacting. Giancotti and Farina[16] highlighted the importance of the use of intermascellar elastics during distalization with aligners to prevent the uncontrolled proclination of anterior teeth. The results were confirmed by Ravera et al[19]. To ensure treatment success, maximum cooperation from the patient appeared to be important. Molar class correction with distalization is a long treatment and results become clear to laypeople only after some months. In order to maintain high levels of compliance, in both cases an aesthetic start was requested by correcting the anterior crowding from the first aligners[16].

Conclusion

Invisalign seems to be effective in correction of Class III malocclusion with distalization from 2 to 3 mm of mandibular molars in non-growing patients. Compliance is very important in this kind treatment; the use of Class III elastics is mandatory to avoid anterior loss of anchorage. To maintain a high level of compliance, an aesthetic start, with correction of anterior crowding, is suggested.

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