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**CORREÇÃO DA MORDIDA ABERTA ANTERIOR UTILIZANDO O
SISTEMA INVISALIGN®: RELATO DE CASO**

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**CORREÇÃO DA MORDIDA ABERTA ANTERIOR UTILIZANDO O
SITEMA INVISALIGN®: *RELATO DE CASO***

Versão final

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Aos 11 dias do mês de dezembro de 2018, às 8:00 horas, na sala de Pós-Graduação (3418) da Faculdade de Odontologia, reuniu-se a Comissão Examinadora, composta pelos professores Soraia Macari (orientador), Flávia Uchôa Bartolomeo e Marcelo de Araújo Lombardi. Em sessão pública foram iniciados os trabalhos relativos à Apresentação da Monografia intitulada **“Correção da mordida aberta anterior utilizando o sistema Invisalign: relato de caso”**. Terminadas as arguições, passou-se à apuração final. A nota obtida pela aluna foi 100 (CEM PONTOS) pontos, e a Comissão Examinadora decidiu pela sua APROVAÇÃO. Para constar, eu, Soraia Macari, Presidente da Comissão, lavrei a presente ata que assino, juntamente com os outros membros da Comissão Examinadora. Belo Horizonte, 11 de dezembro de 2018.

Prof. Soraia Macari

Orientador

Prof. Flávia Uchôa Bartolomeo

Prof. Marcelo de Araújo Lombardi

A Deus, pelas oportunidades e pelas vitórias conseguidas, aos meus pais e irmãos por serem minha fortaleza. Ao meu esposo pelo apoio e incentivo durante os momentos difíceis.

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“Se temos de esperar, que seja para colher a semente boa que lançamos hoje no solo da vida. Se for para semear, então que seja para produzir milhões de sorrisos, de solidariedade e amizade.”

Cora Coralina

RESUMO

O tratamento ortodôntico da mordida aberta continua sendo um dos grandes desafios que os ortodontistas enfrentam atualmente, pois a incompetência vertical dos arcos devido à má posição dentária ou esquelética não permite a oclusão correta entre dentes antagonistas. Uma tecnologia relativamente nova, chamada Invisalign® (Align Technology, Santa Clara, CA, EUA), tem sido amplamente utilizada na ortodontia há aproximadamente 20 anos. O conforto e a estética proporcionados por esse sistema se tornam bastante atraentes, principalmente para pacientes adultos. O objetivo deste estudo é relatar um caso de mordida aberta anterior em um adulto tratado com Invisalign®. Paciente de 40 anos apresentou a queixa principal de mordida aberta anterior. A avaliação oral extra revelou presença de selamento labial ativo, aumento do terço inferior da face e mordida aberta anterior. O objetivo do tratamento foi corrigir a mordida aberta anterior, a mordida cruzada posterior e promover o correto nivelamento e alinhamento dos dentes. Como a paciente relutava na abordagem da cirurgia ortognática, o tratamento ortodôntico focou na compensação dentária, mesmo que um problema esquelético tivesse sido detectado. Após uma fase inicial com o esporão lingual, que durou 5 meses, foi possível observar um fechamento considerável da mordida aberta anterior. Em seguida, utilizou uma série de 25 alinhadores, além da redução interproximal (IPR) na região dos incisivos superiores e inferiores, juntamente com attachments otimizados. A paciente trocou os alinhadores com um intervalo de 15 dias. Foi necessário o uso de alinhadores adicionais para que o caso fosse melhor finalizado. No final do tratamento, a mordida aberta anterior inicial foi completamente fechada.

Palavras-chave: Ortodontia. Aparelhos ortodônticos removíveis. Cirurgia ortognática.

ABSTRACT

Correction of the anterior open bite using the Invisalign system: Case Report

Orthodontic treatment of open bite remains one of the most difficult challenges orthodontists face nowadays, as vertical incompetence of the arches due to poor dental or skeletal position does not allow correct occlusion between antagonistic teeth. A relatively new technology, called Invisalign® (Align Technology, Santa Clara, CA, USA), has been widely used in orthodontics for approximately 20 years. The comfort and aesthetics provided by this system become quite attractive, especially for adult patients. The objective of this study is to report a case of anterior open bite in adult treated with Invisalign®. A 40-year-old patient had the chief complaint of anterior open bite. The extra oral evaluation revealed the presence of an active lip seal, increased lower third of the face along with anterior open bite. The treatment objective was to correct anterior open bite, posterior crossbite and to promote proper teeth leveling and alignment. Because the patient was reluctant of orthognathic surgery approach, the orthodontic treatment focused on dental compensation even though a skeletal problem was diagnosed. After an initial phase with the lingual spur, which lasted 5 months, it was possible to observe a considerable closure of the anterior open bite. After that, the patient used a series of 25 aligners, besides interproximal reduction (IPR) in the region of upper and lower incisors, along with optimized attachments. The patient changed aligners with an interval of 15 days. It was necessary to use additional aligners so that the case would be better finalized. At the end of the treatment the initial anterior open bite was completely closed.

Keywords: Orthodontics. Orthodontic appliances, Removable. Orthognathic surgery.

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LISTA DE ABREVIATURAS E SIGLAS

IPR Interproximal Reduction

LISTA DE SÍMBOLOS

® Marca registrada

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1 INTRODUÇÃO

O tratamento da mordida aberta anterior continua sendo um dos maiores desafios que os ortodontistas enfrentam atualmente, uma vez que a incompetência vertical dos arcos dentários devido à um mal posicionamento esquelético não permite uma correta oclusão entre os dentes antagonistas¹. É também um desafio devido às dificuldades associadas com as técnicas utilizadas para a correção e sua consequente instabilidade da correção, dependência da severidade, etiologia e tempo de tratamento¹. A etiologia da mordida aberta anterior é complexa e multifatorial; ela pode se desenvolver tanto de hábitos bucais deletérios, crescimento excessivo dos tecidos linfáticos, posicionamento lingual atípico, ou ainda ter uma predisposição genética³. Terapias incluem modificar anomalias funcionais ou de hábitos, tratamento ortopédico, cirurgia ortognática, e tratamento ortodôntico com extrusão dos dentes anteriores e extrusão dos dentes posteriores⁴, dependendo do que está causando o problema.

Uma tecnologia relativamente nova, chamada Invisalign® (Align Technology, Santa Clara, CA, USA), vem sendo usada na ortodontia por aproximadamente 20 anos. Uma das grandes vantagens desse sistema é a possibilidade de o ortodontista conseguir planejar o tratamento por completo através de um software de planejamento digital chamado ClinCheck®. A aplicação e implementação do ClinCheck®, juntamente com a tecnologia CAD/CAM, estereolitografia, e a representação tridimensional da situação clínica^{5,6} tornam o sistema muito efetivo. Inicialmente, o Invisalign® conseguia tratar apenas casos de alinhamentos simples à moderados que não envolviam extrações⁵, mas a tecnologia desenvolveu muito nos últimos anos e atualmente o ortodontista pode tratar as mais severas má oclusões, incluindo a mordida aberta anterior.

2 OBJETIVO

O objetivo desse trabalho foi relatar um caso de uma paciente adulta com mordida aberta anterior tratada com Invisalign®.

3 RELATO DE CASO

O relato de caso será apresentado em formato de artigo, em língua inglesa de acordo com as normas da revista científica American Journal of Orthodontics and Dentofacial Orthopedics (AJO-DO).

4 ARTIGO CIENTÍFICO EM INGLÊS

4.1 INTRODUCTION

Orthodontic treatment of open bite remains one of the most difficult challenges orthodontists face nowadays, as vertical incompetence of the arches due to poor dental or skeletal position does not allow correct occlusion between antagonistic teeth¹. It is also a challenge because of difficulties associated with known treatment techniques and the consequent instability of the correction, dependence on severity, etiology, and time of treatment². The etiology of anterior open bites is complex and multifactorial; it may develop from either oral habits, excessive growth of lymphatic tissues, tongue position, or a genetic predisposition³. Therapies include modification of functional or habitual abnormalities, orthopedic treatment, orthognathic surgery, and orthodontic treatment with extrusion of the anterior teeth or intrusion of the posterior teeth⁴, depending on the main cause.

A relatively new technology, called Invisalign® (Align Technology, Santa Clara, CA, USA), has been widely used in orthodontics for approximately 20 years. One of the great advantages of this system is the possibility of the orthodontist to plan the entire treatment through a digital planning program called Clincheck®. The application and implementation of the ClinCheck® method, along with CAD/CAM technology, stereolithography, and the three-dimensional digital representation of the clinical situation^{5,6} makes the system very effective. In addition, the comfort and aesthetics provided by this system become quite attractive, especially for adult patients. Initially, Invisalign® could handle simple to moderate nonextraction alignments⁵, but the technology has developed enormously in the past years and now the orthodontist is able to treat even the most severe malocclusions, including the anterior open bite.

In this way, the objective of this study is to report a case of anterior open bite in adult treated with Invisalign®.

4.2 DIAGNOSIS AND ETIOLOGY

A 40-year-old patient was referred by the buco-maxillofacial surgeon, with the chief complaint of anterior open bite. The extra oral evaluation revealed the presence of an active lip seal, increased lower third of the face and low smile line. Also, the patient presented a convex profile, open nasolabial angle and a reduced chin-neck line. During intra oral examination was observed the presence of a Class II right subdivision, anterior crowding, upper incisors retroinclined and retruded, while the lower incisors were vestibularized and protruded. Moreover, the patient presented a posterior crossbite and an anterior open bite with lingual interposition (Figure 1).



Figure 1:40-year old patient complaining of anterior open bite, before start treatment (A – H)

The panoramic radiography demonstrated the presence of all the teeth, except for the third molars, good root lengths and absence of bone loss. Using the teleradiography it was possible to perceive the tendency of vertical growth. Similarly to the clinical exam the upper incisors were retroinclined and retruded, while the lower

incisors were vestibularized and protruded. The maxilla was well positioned relative to the base of the skull, while the mandible was retruded (Figure 2, Table 1).

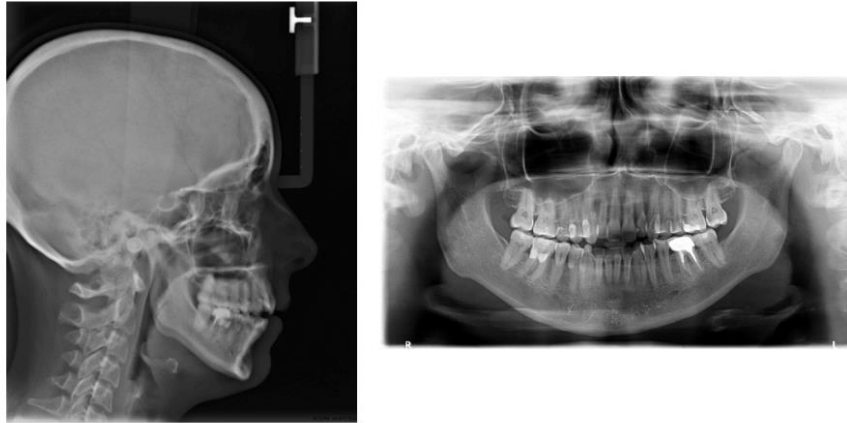


Figure 2: Pre-treatment teleradiography and panoramic radiography

	Inicial	Final	Normal
SNA	75,12°	77,22°	82,00°
SNB	71,13°	72,88°	80,00°
ANB	4,00°	4,34°	2,00°
1.NA	15,34°	11,44°	22,00°
1.NB	29,88°	28,73°	25,00°
1.1	130,79°	135,39°	131,00°
1-NA	3,32 mm	2,36 mm	4,00 mm
1-NB	6,62 mm	7,10 mm	4,00 mm
Go-Gn.SN	41,99°	39,66°	67,00°
Ocl.SN	27,69°	20,92°	14,00°
FMA	26,65°	30,91°	25,00°
IMPA	94,52°	94,61°	90,00°

Table 1: Initial and final cephalometric measurements

4.3 TREATMENT OBJECTIVE

The treatment objective was to correct anterior open bite, posterior crossbite and to promote proper teeth leveling and alignment. Because the patient was reluctant of orthognathic surgery approach, the orthodontic treatment focused on dental compensation even though a skeletal problem was diagnosed.

4.4 TREATMENT ALTERNATIVES

Since the aim of the treatment was to close the anterior open bite without orthognathic surgery, three alternatives treatments were proposed:

- 1 – Extraction of four premolars and mechanics for closing spaces with standard brackets,
- 2- Placement of mini-plates to perform an intrusion of the posterior teeth using standard brackets,
- 3 – Lingual spur and Invisalign® system.

The patient has opted for the third treatment option, since it would not involve any type of invasive surgery. In addition, she also took into consideration the comfort and aesthetics that clear aligners provides.

4.5 TREATMENT PROGRESS

The main complaints of the patient were the labial incompetence and the anterior open bite. She reported that the anterior open bite affected her both aesthetically and functionally due to some speech difficulties.

The proposed treatment included a two phase therapy, (1) lingual spur to initially close the open bite the maximum as possible and then (2) corrective treatment with the Invisalign system.

Dental compensations were performed to correct the skeletal problem because the patient was reluctant to have surgery, procedure which was very well explained to the patient. The lingual spur was the first phase of treatment to removal of the lingual interposition between the incisors helping to close the anterior bite (Figure

3). Along with the lingual spur, the patient was submitted to a lingual frenectomy, due to speech difficulties.



Figure 3: The use of the lingual spur shows a significantly closure of the anterior open bite

Once some improvement was observed after the first phase, the second phase, involving orthodontic tooth movement with the Invisalign system was started. The goal of this period was the expansion of the arches and the extrusion of the anterior teeth; and by reciprocal force there has also been the intrusion of the posterior teeth which facilitated the closure of the anterior open bite.

4.6 TREATMENT RESULTS

After the initial phase with the lingual spur, which lasted 5 months, it was possible to observe a considerable closure of the anterior open bite (Figure 3). Once some improvement was obtained the patient started to use the clear aligners to correct the remaining open bite (Figure 4, Table 2). The initial Clicheck® stipulated a treatment with 25 aligners, the last 3 of overcorrection, besides interproximal reduction (IPR) in the region of upper and lower incisors, along with optimized attachments on the teeth 1.4-2.4 and 4.4-3.5 (Figure 5) - the patient changed aligners with an interval of 15 days. It was necessary to use additional aligners so that the case would be better finalized, together with an elastic mechanics in the vestibular and palatal facets of the tooth 1.2 for the correction of an excessive vestibular inclination (Figure 6). At the end of treatment, the anterior and lateral dislocation guides were successfully obtained (Figure 7). The main objective of the treatment – close the anterior open bite – was achieved. The gyroversions were also corrected, in the same way as the anterior crowding and the inclination of the incisors proved satisfactory. In addition, at the end of the treatment both the upper and lower arches presented a good shape (Figure 8). However, the class II right subdivision was not corrected.

Region	Open bite - inicial
12 - 42	3,5 mm
11 - 41	2,5 mm
21 - 31	1,5 mm
22 - 32	3,5 mm

Table 2: Open bite (in mm) after use of the lingual spur



Figure 4: Patient already using Invisalign®, the day the attachments were installed (A – E)

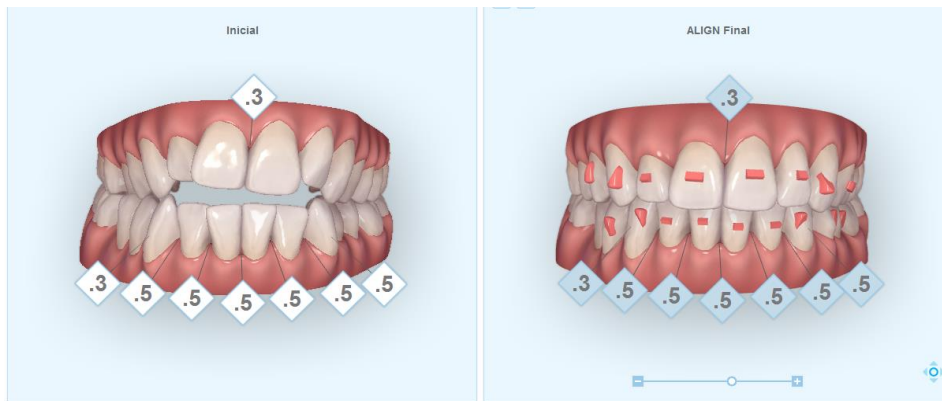


Figure 5: Images of the Clincheck® showing the initial situation and the final



Figure 6: Patient using Invisalign® in a more advanced stage of the treatment, associated to an elastic to improve the slope of the tooth 1.2 (A-C)



Figure 7: All disocclusion guides were reached at the end of treatment (A-C)

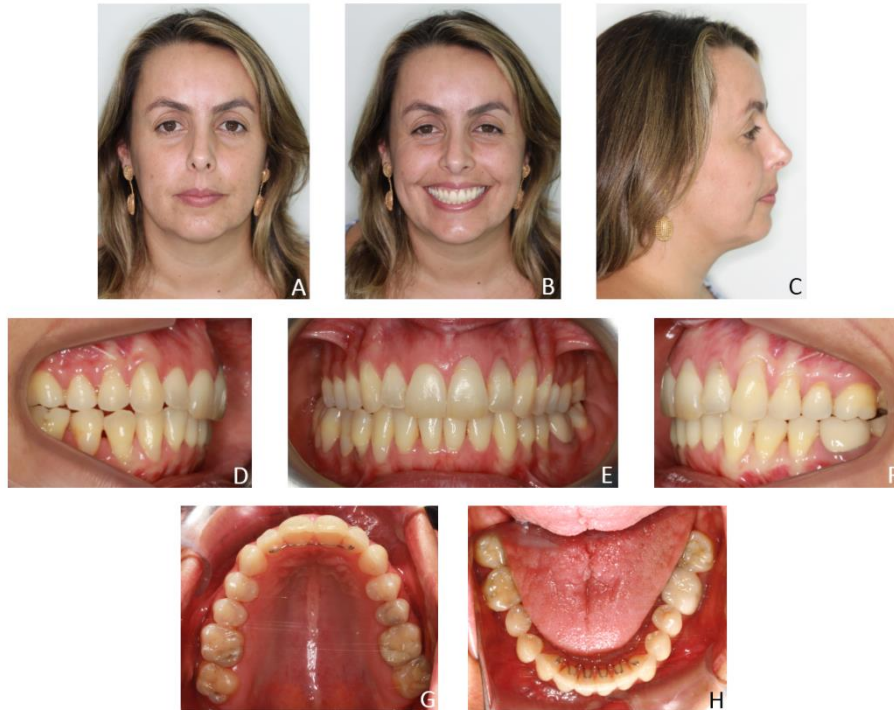


Figure 8: Post-treatment photographs showing that the patient had a very satisfactory smile and that the previous open bite was completely corrected (A-H). The small Class II right subdivision was accepted since the functions were correct.

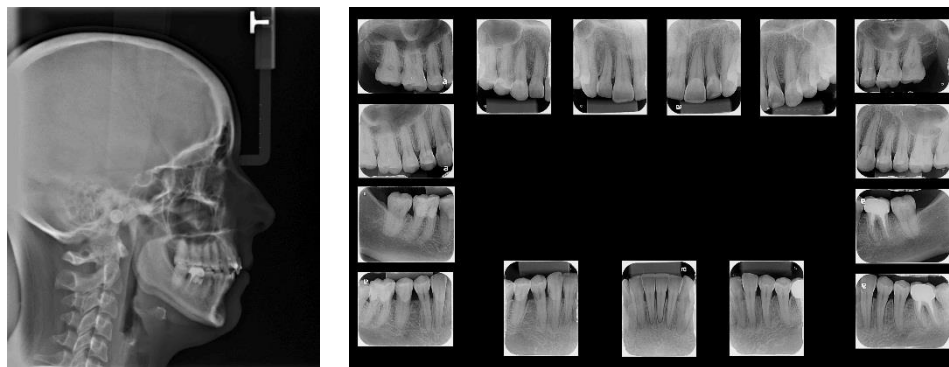


Figure 9: Final radiographs showing the anterior bite closure and also no root reabsorption during treatment.

When observing the final periapical x-rays, we see that there was no considerable root resorption in any dental element (Figure 9). Analyzing the initial and final cephalometry was possible to observe that the skeletal class II relation was maintained, but the position of both upper and lower incisors were considerably improved. Upper incisors at the end of treatment were retroinclined and retruded, whereas lower incisors were vestibularized and protruded (Table 1). When the initial and final cephalometric tracings were overlap by the SN line, it can be observed that the incisors in which previously had no contact presented a close relation with just overbite and overjet, along to immediate anterior guide (Figure 10). In addition, it can also be noticed a better lip ratio as well as an anti-clockwise rotation of the jaw allowing the lip sealing and the patient was instructed to seek a speech therapist to assist with

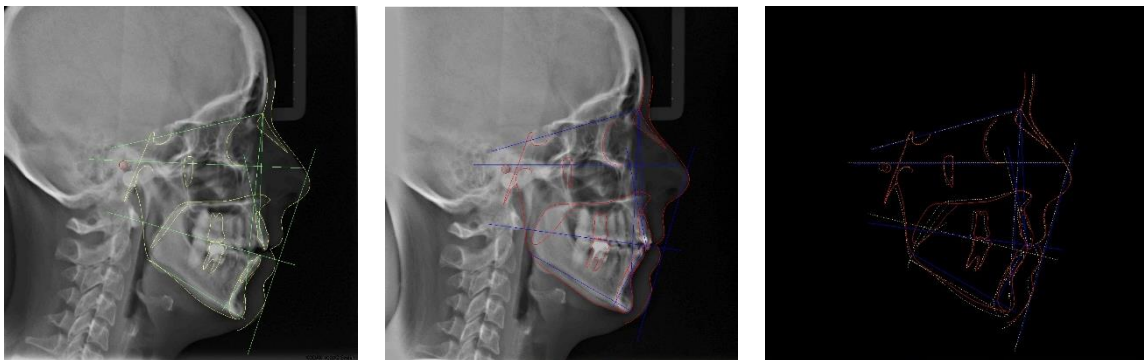


Figure 10: Cephalometric overlap showing incisor extrusion, lip sealing and slight jaw rotation counterclockwise.

At the end of treatment, removable retainers were installed in both arcades.

4.7 DISCUSSION

The case reported in this study was the compensatory orthodontic treatment of anterior open bite using the Invisalign system, shortly after the use of a lingual spur, since the patient was not interested in very invasive procedures, such as orthognathic surgery.

Orthodontic treatment of the anterior open bite remains a challenge for most orthodontists, mainly because there is a high risk of relapse^{1,3,4,7,8}. For many years, orthognathic surgery was the treatment of choice for many professionals. Maxillary

repositioning is often used to obtain jaw counterclockwise rotation and reduction of anterior facial height in patients with severe skeletal open bite⁴. However, orthognathic surgery requires surgical invasion with postoperative discomfort and risks, as well as prolonged hospitalization⁹ and this often discourages the patient who does not want to undergo a very invasive procedure. Therefore, when the patient refuses surgery the orthodontist must present a different yet effective treatment option.

In this clinical case the patient had no facial complaints, and reported that the anterior open bite affected her both aesthetically and functionally due to some speech difficulties. Although she was referred by the bucco-maxillofacial surgeon, it was not her intention to have orthognathic surgery. Also, she wanted the most aesthetic and comfortable treatment alternative, so we opted for Invisalign®.

Flores -Mir et al.¹⁰ demonstrated in their study that patients treated with Invisalign® in comparison with standard brackets were more satisfied when eating and chewing . Aditya Chhibber et al. ¹¹ compared patients treated with clear aligners, self-ligating brackets and standard brackets and concluded that the group that used clear aligner presents lower plaque index, gingival index and papillary bleeding index. Based on those information, we decided to pursue this treatment option, but after an initial phase with the lingual spur.

The use of the lingual spur was proposed as a way to reduce the open bite. Lingual spur is an effective method for treating anterior open bite in patients with atypical swallowing due to lingual pressing¹². Even though these results were obtained with growing patients, we decided to try this approach with an adult expecting some improvement, which was successfully obtained.

When comparing children with anterior open bite and normal overbite Paola Botero-Mariaca et al¹³. noticed that speech alterations were more common on the first group. There were also associations between anterior open bite and the presence of lingual interposition, lingual thrust, distortion, protrusion of the tongue, contact with the palatine rugae and type of dentition. In his study Parker¹⁴ concluded that patients with open bite treated earlier during their growth phase had an excellent prognosis after correction. Huang et al.¹⁵ established that patient with anterior open bite treated with palatal crib, which is very similar to the spur, presented satisfactory stability in the correction of the bite 1 year after the end of treatment. It is well established in the orthodontic literature that the prognosis for a patient with anterior open bite treated during the growing phase by removing the atypical lingual positioning is good.

However, it is difficult to find studies demonstrating the long-term stability of adults who were treated for anterior open bite with lingual spur. Since this approach does not harm the patient in any way, we decided to try it since any improvement would be very welcome.

The lingual frenectomy was indicated for the patient once she presented speech difficulties due to Ankyloglossia, also known as tongue-tie. This anatomic condition may have an impact on tongue function and it can also interfere with the shape of the dental arches and their consequent occlusion¹⁶. After this procedure, an improvement in the speech was observed.

Once the anterior open bite was reduced with the lingual spur, the treatment with Invisalign® began. Using the ClinCheck® program the extrusion of the anterior mandibular and maxillary incisor were planned, along with intrusion of the posterior teeth, expansion of the arches and correction of the Class II right subdivision. A recent study¹⁷ showed that the least accurate movement with clear aligners was the extrusion of anterior teeth, being the central incisors in both arches the teeth with worse results. In the case reported, it is possible to observe that although there is less accuracy in this movement, the upper and lower incisors were successfully extruded. The same study stated that intrusion was relatively easier to achieve on the posterior teeth, which corroborates with what we observe in this study. Khosravi et al.¹⁸ showed that overbite was improved in patients with anterior open bite mainly by the extrusion of the maxillary and mandibular incisors, and did not report an important role of intrusion of the posterior teeth. Orfeas Charalampakis et al.¹⁹ evaluated the amount of movement planned in the ClinCheck® and the movement actually achieved and determined that the extrusion of incisor is an accurate movement. All these studies corroborate with our report showing a good extrusion of the upper and lower incisors and the full closure of the anterior open bite.

Orfeas Charalampakis et al.¹⁹ also verified in their study that the ClinCheck® was not very effective planning some movements, like intrusion of central incisors. Solano-Mendoza et al.²⁰ stated that the final planning in the ClinCheck® was not exactly what was clinically found at the end of treatment, as we could observe with this patient, once a second ClinCheck® was necessary to fully close the anterior open bite. Therefore, we recommend that some overcorrection should be planned in order to achieve a good finalization.

The quality of the patient's periodontium, together with some orthodontic mechanics, among them the use of elastics, can cause gingival retraction²¹. For this reason and because the patient already presented gingival recessions it was decided to keep the class II subdivision right once the disocclusion guides were satisfactory, besides the patient was extremely happy with the final result of the treatment. It is also very important to emphasize that one of the main reasons for the success of the treatment was the correct use of the aligners by the patient.

4.8 CONCLUSION

- 1- Open bite can be successfully treated with Invisaling® system in adult patients by the extrusion of anterior teeth and intrusion of posterior teeth, without involving orthognathic surgery;
- 2- The lingual frenectomy can be indicated for the patient that presents speech difficulties due to Ankyloglossia;
- 3- The lingual spur can help the closure of the anterior open bite by removing tongue interference;
- 4- ClinCheck® may be inaccurate for some dental movements, so we recommend that overcorrections be planned.

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