Annals of Case Reports
Hitti M and Erbe C. Ann Case Rep: 9: 101686
www.doi.org/10.29011/2574-7754.101686
www.gavinpublishers.com

Case Report

Hybrid Non-Surgical Orthodontic Treatment of a Skeletal and Dental Class II, Division 2

Mirette Hitti, Christina Erbe*

Department of orthodontics, University Medical Center of the Johannes Gutenberg-University, Mainz, Germany

***Corresponding author**: Christina Erbe, Department of Orthodontics and Dentofacial Orthopedics, University Medical Center of the Johannes Gutenberg-University, Mainz, Germany

Citation: Hitti M, Erbe C (2024) Hybrid Non-Surgical Orthodontic Treatment of a Skeletal and Dental Class II, Division 2. Ann Case Report. 9: 1686. DOI:10.29011/2574-7754.101686

Received: 28 February 2024, **Accepted:** 04 March 2024, **Published:** 06 March 2024

Abstract

With a prevalence of over 30% temporomandibular joint dysfunction (TMJ) is the most common chronic pain disorder in the maxillofacial region [1]. The therapy requires an interdisciplinary, individually adapted treatment approach. This case presentation is intended to provide an insight into the treatment concept of a posterior forced bite of an adult patient with dental and skeletal Class II, division 2 malocclusion treated with the Herbst appliance and a partial multibracket appliance from teeth 13-23 followed by clear aligners (Invisalign®) in the upper and lower jaw without orthognathic surgery.

Keywords: Herbst appliance; Aligner; Invisalign®; Class-II-Malocclusion.

Introduction

The Class II malocclusion is still the most frequently treated orthodontic malocclusion [2,3]. Angle divided the dental Class II malocclusion into Class II, division 1 with protruded maxillary incisors and a Class II, division 2 with returned, steeply positioned maxillary incisors, which is often described as a overbite. These patients usually have a reserve of the lower jaw [4]. Especially in Angle Class II, division 2, the genetic component is emphasized as a possible aetiology. Depending on the skeletal and dental age, removable and fixed appliances are available as treatment options [5,6]. The aim is to develop the mandible forward to achieve a physiologic condylar position [5-7]. Temporomandibular joint dysfunction (TMJ) is one of the most common chronic pain symptoms in the oral and maxillofacial region today [1]. In addition to head, neck and back pain, crepitation and clicking of the temporomandibular joints are usually found [8,9]. Within the orofacial system, a distinction should be made between articular and muscular pain. However, somatic disorders (axis I) and psychosocial factors (axis II) also have an influence on TMJ [8,10]. Thus, TMJ is a multifactorial process that is made up of psychosocial factors such as stress, anxiety, depression, a genetic disposition (gene polymorphisms) and local causes such as an occlusal factor. Iatrogenic causes such as orthodontic treatment, prosthetic or conservative restorations can also promote TMJ. Changes to the occlusion can lead to compression (usually of the bilaminar zone) or distraction of the temporomandibular joints. Conversely, however, orthodontic treatment of a malocclusion can improve an existing TMJ. It has been shown that Angle Class II patients have a higher prevalence of TMJ and these patients benefit from an orthodontic treatment [11-13]. The occlusal factor is therefore a frequent contributing cause of the symptoms in these patients. In addition to orthodontic bite adjustment to the new therapeutic target position, physiotherapeutic self-exercises (mouth opening exercises, cherry stone sucking, self-massage) should be performed, as well as additional manual therapy if necessary [14]. This case presentation is intended to provide an insight into a non-surgical treatment concept for an adult patient with dental and skeletal Class II, division 2 posterior forced bite.

Case Presentation

The case described here represents the treatment of an adult patient with skeletal and dental Class II, division 2 with posterior forced bite. The patient was treated with a Herbst appliance and maxillary partial multibracket appliance with subsequent aligner therapy (Invisalign®) in the upper and lower jaw.

Findings

Medical history

The patient had his first visit at the Department of Orthodontics and Dentofacial Orthopedics of the University Medical Center Mainz at the age of 24 years. He suffered from pronounced chronic pain symptoms in the area of the temporomandibular joints on both sides and in the head and neck area (Figure 1).

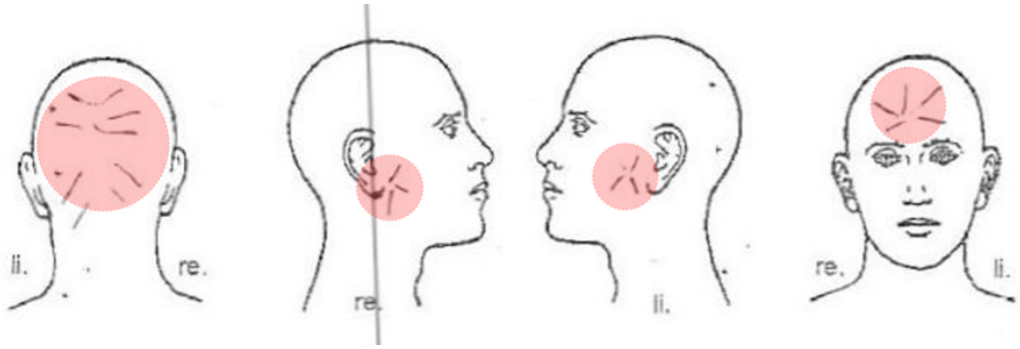

Figure 1: Pain drawing of the patient´s pain questionnaire.

Two different allergies (hay fever and house dust) were listed in the general medical history. The patient stated that he suffers from sleep disorders. The profile analysis revealed a convex lateral profile with a pronounced sacramental fold. The patient showed a shortened upper and lower third of the face and the buccal corridors were enlarged. The patient was already undergoing manual therapy for pain in the masticatory muscles as well as head and neck pain. The functional examination showed a shortening of the suprahyoid muscles, a reproducible terminal temporomandibular joint clicking on both sides with a dorso-cranial load vector in combination with a posterior forced bite. The first contact after neuromuscular deprogramming was onto teeth 21/31. The patient suffered from parafunctional bruxism. Grinding facets and gingival recessions on teeth 14, 13, 12, 23 and 24 were clearly visible. Therefore, there was clinical evidence of TMJ. Mm. Masseter and Mm. temporalis were dolent on pressure. The neck and shoulder muscles were tense.

Extra oral findings

The extra oral findings showed an average face, inclined backwards (Figure 2). The lower and upper third of the face was shortened. The profile was convex, with a negative lip line and a slightly reduced nasolabial angle with a straight nasal bridge.

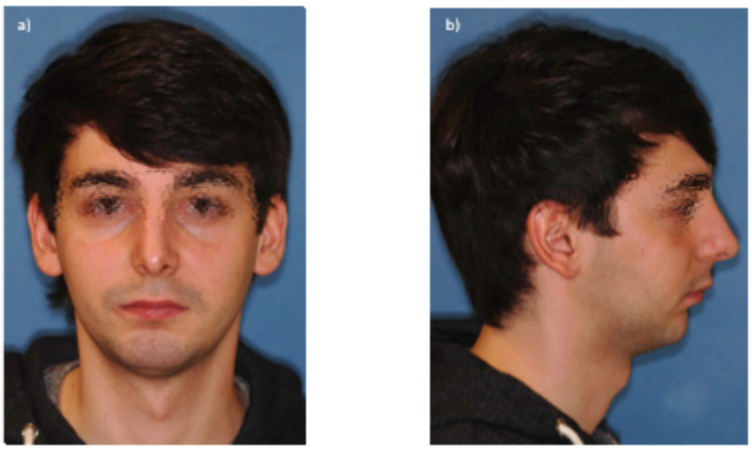

Figure 2: Extraoral findings a) Frontal view b) Right side profile

Intraoral findings

Intraorally, a permanent, fully toothed dentition (17-47) with good oral hygiene was found (Figure 3&Figure 4). Ground facets and gingival recessions were clearly visible on teeth 14, 13, 12, 23 and 24.

Figure 3: a) Intraoral view frontal b) Intraoral view right c) Intraoral view left d) Maxillary supervision e) Mandibulary supervision f) Situation after neuromuscular deprogramming.

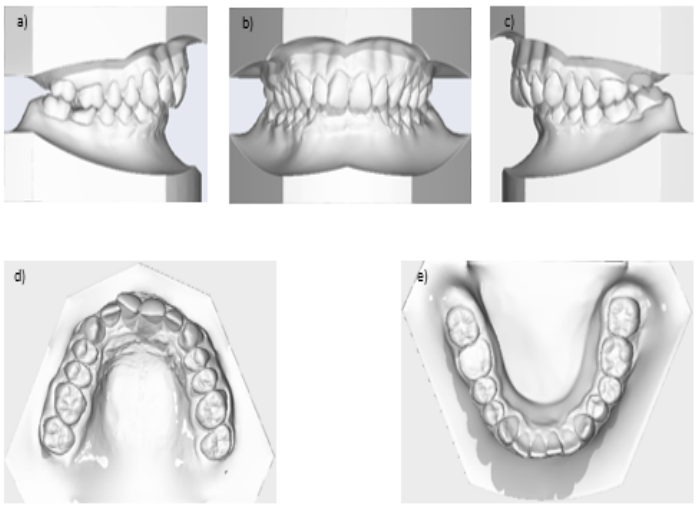

Figure 4: Pre-treatment models: a) Intraoral view frontal b) Intraoral view right c) Intraoral view left d) Maxillary supervision e) Mandibulary supervision

Clinically, after neuromuscular deprogramming, there was a forced bite component over tooth 21/32 (Figure 3 d). The maxilla showed a narrow dental arch in the anterior region. The upper incisors were strongly returned with a pronounced anterior crowding, a slight mesial position of the posterior teeth on the right side and a superposition of teeth 13, 11, 21 and 23. Tooth 11 showed a distinct mesiorotation. The ALD was calculated with -2.5 mm. The mandible also showed a narrow dental arch in the anterior region. The mandibular front teeth were normal inclined, but crowded and teeth 33-43 were in superposition. The Speed curve was very pronounced. The filling on tooth 46 was insufficient. The ALD was calculated with -2mm. The patient had a pronounced overbite with a posterior forced bite and thereby resulting TMJ. The overjet was 0.5 mm at tooth 21 to 31 and 3 mm at tooth 11 to 41. There was a dental-supported deep bite, the overbite was 7mm. The patient showed a one cusp Class II molar relationship on the right side and a ½ cusp Class II molar relationship on the left side with a skeletal relationship of a ½ cusp Class II.

Radiological findings

The panoramic radiograph (Figure 5a) showed a conservatively restored adult dentition. All sapientes except for 28 were in place, but impacted and partially displaced. A root canal-treated tooth 46 with an insufficient filling was visible. The maxillary sinuses were deeply pneumatized. The temporomandibular joints appeared unremarkable in a lateral comparison. No radiographic abnormalities were detected.

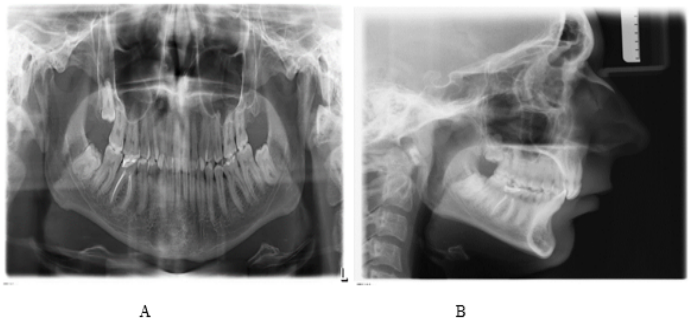

Figure 5: a) Panoramic radiograph at the start of treatment; b) Cephalometric radiograph at the start of treatment

Analysis of the cephalometric radiograph (Fig 5 b) showed a disto-basal jaw relation (ANB 10°; WITS 5mm) with an orthognathic maxilla (SNA 80°) and a retro gnathic mandible (SNB 70°) with a dolichofacial craniofacial set-up.

The mandible showed a normal inclination, which together with the slight posterior inclination of the maxilla resulted in a normodivergent vertical jaw relation. The maxillary incisors were strongly returned (maxillary I-NL 80°), while the mandibular incisors showed a normal inclination (mandibular I-ML 95°). Therefore, the interincisal angle was increased with 161°. The dentally supported deep bite was of skeletal origin due to the posterior inclination of the maxilla and the slightly reduced vertical jaw relation and of dental origin due to the superposition of the lower anterior teeth and the pronounced Spee's curve. The Class II dentition and the overbite appeared to be of both dentoalveolar and skeletal origin.

Treatment goal

The main goal of the treatment was to eliminate the posterior forced bite and forward displacement of the mandible to relieve tension in the temporomandibular joints while setting a physiologic overjet and overbite.

Treatment objectives

The patient asked for a non-surgical procedure, however he was informed about the need of orthodontic surgery if the treatment is unsuccessful. The mandibular advancement should be performed with the Herbst appliance. In addition, it was taken advantage of the distalizing and expanding side effects of the Herbst appliance. At the same time, the upper incisors were protruded and torqued by using a partial multibracket appliance. Followed by a treatment with upper and lower aligners (Invisalign®) and intermaxillary Class II elastics on both sides. With the aligners (Invisalign®) the lower front was intruded while levelling the curve of Spee, further

torqueing the upper incisors and adjusting the occlusion. After the active orthodontic treatment was completed, the treatment result was stabilised with a cuspid-to-cuspid bonded retainer in the upper and lower jaw and a retention activator to retain the adjusted sagittal and vertical relation of the jaws.

Course of treatment

Initially, the patient was instructed to perform physiotherapeutic self-exercises (mouth opening exercises, self-massage, sucking cherry pits, spatula exercises) to stretch his shortened suprahyoid muscles in order to minimize the risk of a post-therapeutic recurrence. Those exercises were supported by regular sessions with a manual therapist. The Herbst appliance was inserted (Figure 6), adjusted in a frontal head bite, anchored in the upper jaw on the teeth 14-16 (occlusal support 17) 24-26 (occlusal support 27) and in the lower jaw on the teeth 33-36 and 43-46. In the same session, brackets were bonded on the teeth 13-23 and a .014 NiTi arch wire was ligated. In the following months, the arch wire in the upper jaw was changed up to .016 x .016 SS. The distalization effect of the Herbst appliance was used to distalize the cuspids by layering brackets onto the Herbst appliance in regions 14 and 24.

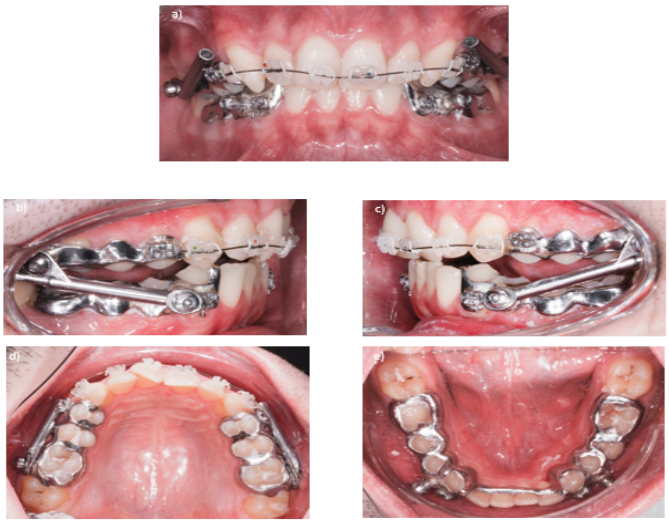

Figure 6: Herbst appliance with partial multibracket appliance in situ a) Intraoral view frontal b) Intraoral view right c) Intraoral view left d) Maxillary supervision e) Mandibular supervision

After 12 months, the Herbst appliance and partial multibracket appliance were removed. Attention was paid to ensure that the new achieved bite position was stable. A slight recurrence in the sagittal position relationship was taken into account. A re-evaluation of the current situation was carried out with diagnostic documents for further treatment planning. An upper/ lower intraoral scan (3shape TRIOS® Straumann) was taken and sent to the aligner manufacturer (Invisalign®, Align technology, San José, CA, USA) in order to digitally simulate the planned tooth movements in the (ClinCheck®, Align technology, San José, CA, USA) simulation software. The treatment plan included in the first set: Torque of the upper anterior teeth and buccal up righting of the upper canines. An intrusion of teeth 33-43 and also buccal up righting of the lower canines. Shaping and levelling of the dental arches. A mandibular jump to the anterior left, which should imitate the Class II elastics, was visualized. The attachments on the teeth were bonded, the aligners inserted (Figure 7) and the patient was instructed how to wear the Class II elastics. The wearing time of the aligners and elastics should not be less than 22h/d. The aligners were changed weekly and the follow-up appointments took place every 8-10 week.

Figure 7: Maxillary and mandibulary aligner (Invisalign®) with attachments and Class II Cut outs in situ a) Intraoral view frontal b) Intraoral view right c) Intraoral view left d) Maxillary supervision e) Mandibular supervision.

After successful completion of the first set aligners, another re-evaluation with diagnostic documents took place and a second set of splints ("additional aligners") was planned. The planned tooth movement included: intrusion and torqueing of the maxillary anterior teeth. Intrusion and retrusion of the lower anterior teeth. Extrusion of the maxillary/mandibular posterior teeth to level the curve of Spee and lift the bite. Further elimination of the rotational and tilting positions. A mandibular jump to the anterior left was also planned here. New attachments were inserted and the new aligners. The same instructions as before still apply. After successful completion of the second set, a re-evaluation with diagnostic documents was carried out again. A third set of aligners (25 aligners) was planned for the final adjustment of teeth. The treatment simulation implemented the following movements:

further intrusion of teeth 11 and 21 and torque of the maxillary front. Slight buccal up righting of the maxillary posterior teeth for transversal expansion and a slight distal tipping of the posterior teeth on the right. Extrusion of the maxillary/mandibular posterior teeth. Further levelling of the dental arches. Visualization of the mandibular jump to the anterior left was planned. At the end of the third set of aligners, another diagnostic documents were made. The treatment result was very good. All planned tooth movements were successfully implemented. The patient's compliance was always very good. The elastics and aligners were worn as instructed. The attachments were removed from the teeth and cuspid-to-cuspid bonded retainers in the upper and lower jaw were inserted for retention. After completion of the active orthodontic treatment, a neutral occlusion was achieved in the molar and canine region on both sides with a physiologic overjet and overbite (Figure 8). The posterior forced bite has been eliminated and a painless situation was achieved.

Figure 8: Final result a) Intraoral view frontal b) Intraoral view right c) Intraoral view left d) Maxillary supervision with cuspid-to-cuspid bonded retainer in situ e) Mandibular supervision with cuspid-to-cuspid bonded retainer in situ.

The analysis of the parameters of the cephalometric radiograph shows that the Class II malocclusion was mainly corrected by dentoalveolar changes in combination with slight skeletal changes (Figure 9 b)) (ANB: 9°, WITS: 1mm, SNA: 80°, SNB: 70.5°, maxillary I-NL: 99°, mandibular I-ML: 99°, interincisal angle: 138°). The sagittal jaw base relationship of Class II improved to a Class I.

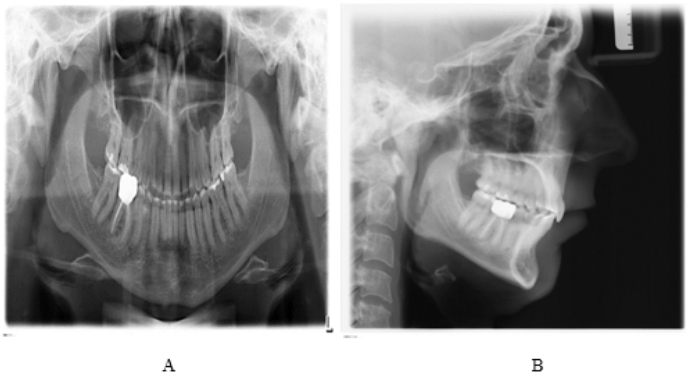

Figure 9: a) Panoramic radiograph at the end of treatment b) Cephalometric radiograph at the end of treatment.

A comparison of the extra oral images before and after treatment shows a clear improvement in the profile in terms of a harmonious face with flattening of the sacramental fold (Figure 10).

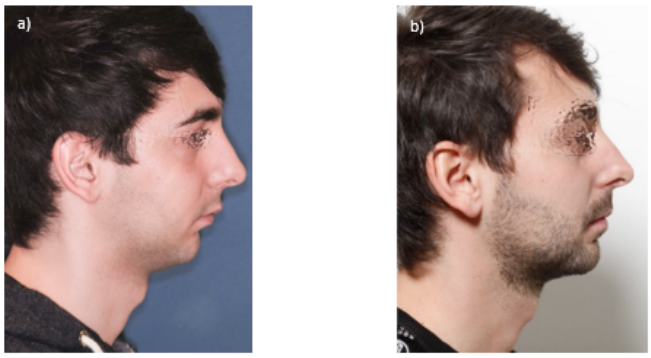

Figure 10: a) Initial findings, right side profile b) Final result, right side profile.

The masticatory muscles were no longer pressure dolent. A significant functional improvement was achieved and the clicking of the temporomandibular joint was eliminated. Interdisciplinary procedure was planned in advance. Tooth 46 was prosthetically restored with a ceramic crown and teeth 18, 38 and 48 were osteotomized. A retention activator was inserted to maintain the transversal, vertical and sagittal jaw relation and for further settling of the posterior teeth. During treatment, the patient underwent rhinoplasty on the recommendation of his ENT specialist to improve nasal breathing. The panoramic radiograph shows good angulation of the roots (Figure 9 a)). No root resorption was noted. Teeth 18, 38 and 48 were extracted. Furthermore the deep maxillary recesses on both sides and the temporomandibular joints appear unremarkable in lateral comparison. Regarding to the growth analysis according to Björk, the following changes can be noted:

General facial changes: (Figure 11 a) During the four years and 5 months treatment period only minor skeletal treatment effects were observed. The sagittal jaw base relationship decreased and also the convexity of the profile regarding a harmonious face. During the retention period the facial changes were small. Due to the natural aging process the soft tissue profile sinked.

Maxillary changes: (Figure 11 b) There seemed to be no growth in the maxilla. However, a slight reduction on the A- point can be observed due to remodelling induced by incisor up righting and palatal root torque. Clearly visible are the dental changes in terms of uprightness and torque of the maxillary incisors. The upper molars were intruded and distalized based on dentoalveolar side effects of the Herbst-Appliance.There seemed to be no growth in the maxilla. The molars and incisors extruded. The incisors showed a slight loss of torque.

Mandibular changes: (Figure 11 c) Relative to the cranial base, slight counter-clockwise rotation of the mandible was observed. Up righting, extrusion and mesialization of the mandibular molars occurred. The mandibular incisors were intruded, slightly protruded and moved bodily forward. This has improved the deep-bite situation. The mandible showed a slight counter-clockwise rotation. The molars extruded and settled even better in occlusion. The incisors moved slightly forward and extruded.

Figure 11: Björk's method of cephalometric superimposition. Black: Pre-treatment Red: Post treatment Green: 2 years Post treatment a) General superimposition (*Please note during treatment a rhinoplasty was performed) b) Superimposition of the maxilla c) Superimposition of the mandible

After completion of active treatment, the patient still attends regularly for retention checks. According to the patient, the retention activator is worn every night. The retention appliance fits very well at every appointment. The lingual retainers are checked. Due to the stable neutral dentition in the posterior region and muscular adaptation, no relapse has been observed until today.

Discussion

In the case presented, we were able to show that a TMJ with a posterior forced bite could be successfully treated by advancing the lower jaw with a Herbst appliance and partial multibracket appliance and orthodontic tooth correction with aligner therapy (Invisalign®). The orthodontic treatment was supported by an interdisciplinary, holistic treatment approach in terms of physiotherapeutic exercises and manual therapy. In order to achieve more skeletal changes in the patient´s profile and to pronounce his chin a genioplasty after treatment could have been performed, but was rejected by the patient. Various studies indicate that a skeletal Class II favours myofascial pain and TMJ [11-13]. These patients in particular benefit from a forward displacement of the mandible. Studies by Ruf and Pancherz show that dental and skeletal changes in the sense of remodelling processes in the articular fossa [15] can also occur in adulthood as a result of the Herbst appliance and that this therapy can therefore be selected as a so-called camouflage treatment as an alternative to an orthodontic surgical treatment [16]. Aligner therapy (Invisalign®) offers adult patients especially the aesthetic aspect of an orthodontic tooth correction with an almost invisible appliance. There are also other advantages in terms of wearing comfort and gingival irritation, as well as the positive influence on bruxism patients [17-19]. In patients with parafunctions (bruxism), the occlusal surfaces are protected from high interocclusal abrasive forces by the aligners [19,20].

Conclusion

The combination of Herbst appliance, partial multibracket appliance in the upper jaw and aligner therapy represents a successful treatment option for treating a skeletal and dental Class II and improving the typical convex profile of the Class II malocclusion even in adults, after the growth peak. This interdisciplinary treatment approach was therefore the treatment of choice for this patient as an alternative to an orthodontic surgery, without the usual risks of a surgical intervention and taking into account the cost-benefit ratio.

References

1. Valesan LF, Da-Cas CD, Réus JC, Denardin ACS, Garanhani RR, et al. (2021) Prevalence of temporomandibular joint disorders: a systematic review and meta-analysis. Clin Oral Investig. 25:441-53.

2. Alogaibi YA, Murshid ZA, Alsulimani FF, Linjawi AI, Almotairi M, et al.

(2020) Prevalence of malocclusion and orthodontic treatment needs among young adults in Jeddah city. J Orthod Sci. 9:3.

3. Akbari M, Lankarani KB, Honarvar B, Tabrizi R, Mirhadi H, et al (2016) Prevalence of malocclusion among Iranian children: A systematic review and meta-analysis. Dent Res J (Isfahan). 13:387-95.
4. McNamara JA, Jr. (1981) Components of Class II malocclusion in children 8-10 years of age. Angle Orthod. 51:177-202.
5. Pancherz H. (1982) The mechanism of Class II correction in Herbst appliance treatment. A cephalometric investigation. Am J Orthod. 82:104-13.
6. LeCornu M, Cevidanes LH, Zhu H, Wu CD, Larson B, et al (2013) Three-dimensional treatment outcomes in Class II patients treated with the Herbst appliance: a pilot study. Am J Orthod Dentofacial Orthop. 144:818-30.
7. Valant JR, Sinclair PM. (1989) Treatment effects of the Herbst appliance. American Journal of Orthodontics and Dentofacial Orthopedics. 95:138-47.
8. Schiffman E, Ohrbach R, Truelove E, Look J, Anderson G, et al. (2014) Diagnostic Criteria for Temporomandibular Disorders (DC/TMD) for Clinical and Research Applications: recommendations of the International RDC/TMD Consortium Network* and Orofacial Pain Special Interest Group†. J Oral Facial Pain Headache. 28:6-27.
9. Slade GD, Greenspan JD, Fillingim RB, Maixner W, Sharma S, et al (2020) Overlap of Five Chronic Pain Conditions: Temporomandibular Disorders, Headache, Back Pain, Irritable Bowel Syndrome, and Fibromyalgia. J Oral Facial Pain Headache. 34:s15-s28.
10. Dworkin SF, LeResche L. (1992) Research diagnostic criteria for temporomandibular disorders: review, criteria, examinations and specifications, critique. J Craniomandib Disord. 6:301-55.
11. Henrikson T. (1999) Temporomandibular disorders and mandibular function in relation to Class II malocclusion and orthodontic treatment. A controlled, prospective and longitudinal study. Swed Dent J Suppl. 134:1-144.
12. Bindayel NA. (2018) Occurrence of Malocclusion in Patients with Orofacial Pain and Temporomandibular Disorders. J Contemp Dent Pract. 19:477-82.
13. Uetanabaro LC, Gerber JT, Dos Santos KM, Meger MN, da Costa DJ, et al. (2023) Prevalence and associated factors of myofascial pain in orthognathic patients with skeletal Class II malocclusion. Oral Maxillofac Surg. 27:25-31.
14. Dinsdale A, Costin B, Dharamdasani S, Page R, Purs N, et al (2022) What conservative interventions improve bite function in those with temporomandibular disorders? A systematic review using self-reported and physical measures. J Oral Rehabil. 49:456-75.
15. Ruf S, Pancherz H. (2006) Herbst/multibracket appliance treatment of Class II division 1 malocclusions in early and late adulthood. a prospective cephalometric study of consecutively treated subjects. Eur J Orthod. 28:352-60.
16. Ruf S, Pancherz H. (2004) Orthognathic surgery and dentofacial orthopedics in adult Class II Division 1 treatment: mandibular sagittal split osteotomy versus Herbst appliance. Am J Orthod Dentofacial Orthop. 126:140-52.
17. Clements KM, Bollen A-M, Huang G, King G, Hujoel P, et al (2003) Activation time and material stiffness of sequential removable orthodontic appliances. Part 2: dental improvements. American Journal of Orthodontics and Dentofacial Orthopedics. 124:502-8.
18. Bollen A-M, Huang G, King G, Hujoel P, Ma T. (2003) Activation time and material stiffness of sequential removable orthodontic appliances. Part 1: ability to complete treatment. American journal of orthodontics and dentofacial orthopedics. 124:496-501.
19. Nedwed V, Miethke R-R. (2005) Motivation, acceptance and problems of Invisalign® patients. Journal of Orofacial Orthopedics/Fortschritte der Kieferorthopädie. 66:162-73.
20. Miller KB, McGorray SP, Womack R, Quintero JC, Perelmuter M, et al. (2007) A comparison of treatment impacts between Invisalign aligner and fixed appliance therapy during the first week of treatment. American Journal of Orthodontics and Dentofacial Orthopedics. 131:302. e1-. e9.