

Orthodontic Correction of a Severe High-Angle Class II with Gummy Smile in an Adolescent with Crohn's Disease

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Abstract

The orthodontic treatment of a 16 years old patient with Crohn's Disease (CD) is reported in this article. The patient was diagnosed since the age of 10 years with CD and was undergoing therapy with immunosuppressant agents. She had a severe high-angle skeletal Class II with gummy smile and a retruded profile. Treatment with 2 posterior and 2 anterior mini-screws with 4 premolar extractions was conducted. Oral breakouts of the disease were triggered by the orthodontic treatment that had to be progressively molded to fit the patient's health conditions. A counter-clockwise rotation of the mandible and enhancement of patient's profile were achieved. Gummy smile was fully corrected. The interactions of the therapy with immunosuppressant agents, and oral breakouts of CD with treatment progress, results and duration are discussed.

Keywords: Crohn's Disease (CD); Inflammatory Bowel Disease (IBD)

Introduction

Crohn's disease (CD) was named after Dr. Burrill B. Crohn who first described the disease in 1932 [1]. It is a chronic inflammation of the gastrointestinal tract and is part of the Inflammatory Bowel Disease (IBD) group [2,3]. Most commonly, it involves the small intestine, but it may affect any part of the gastro-intestinal system, from the mouth to the anus [4,5]. The oral manifestations of the disease are common and are demonstrated by ulcerations that resemble macroscopically and histologically to those appearing in the gastrointestinal tract [4]. The specific etiology of the disease is unknown, but may be due to a combination of factors such as intestinal epithelial dysfunction and defects of mucosal interaction with the intestinal flora. Smoking, ethnicity, oral contraception, diet and family history are considered as risk factors [6].

Crohn's disease is considered as a public health problem [7] with 3.1 to 14.6 new cases diagnosed per 100,000 persons per year in the USA [8]. In Lebanon, the yearly incidence of CD is low and equal to 1.4 per 100,000 people [9], which falls in the medium range of the prevalence reported in Europe and North America.

CD has a familial pattern, and 20% of the patients have reported having 1 direct relative (parent, sibling, cousin) with CD [10].

In the literature, only 2 articles [11,12] to date have described patients with CD in need of orthodontic treatment. In the first article [11], the orthodontic treatment was not undergone. The second article [12] reports 2 cases of children who had braces before the outbreak of the oral lesions and before diagnosis with CD was made. Details of orthodontic treatment were not given.

This article aimed to discuss the case of an adolescent patient diagnosed with CD who had undergone comprehensive orthodontic treatment at our clinics.

Diagnosis and etiology

The patient, a female adolescent, came to the office at age 16 with her parents and was seeking orthodontic treatment (Figure 1). She had been diagnosed with Crohn's disease at age 10 by her pediatric physician after having severe and frequent episodes of diarrhea, loss of appetite, inability to put on weight and fatigue. She was then followed by a pediatric gastroenterologist. The diagnosis was based on the clinical exam, ultrasounds, blood tests, histopathological and endoscopic findings. Her father's cousin had also been diagnosed with Crohn's disease at age 25, after having a series of miscarriages. She had suffered from only mild intestinal symptoms and the disease remained undiagnosed until it had flared up during conception.



Figure 1: Initial extra-oral pictures of the patient at chronological age 16 years.

The chief complaint of the patient was the profile as her “lips didn’t touch at rest”, and her smile as “a lot of gum is showing”. Her mother felt that the treatment would enhance her daughter’s esthetics, boost her confidence and help her integrate better with her peers, as she had to skip a lot of school days because of the breakouts of the disease and the treatment itself. Oral manifestations of the disease were represented by frequent ulcerations that were described as long painful spots that were difficult to heal, and would appear on the inner lips, cheeks, palate and tonsils.

The medical report of the physician showed that the patient had suffered from low bone mineral density in the areas of the hands, vertebrae, and hips, but not in the maxilla or in the mandible. She had a slightly impaired growth. Her chronological age was 16 years but her skeletal age was 2 years behind as indicated in the report. She had reached puberty 18 months ago. The patient had started therapy for CD 3 years ago with an immunosuppressant agent from the family of Azathioprine (Imuran®). She was also taking Vitamin D and Calcium. The systemic and oral manifestations of the disease had been controlled with the therapy, and the disease was currently considered stagnant.

The extra-oral exam of the patient showed a severe lip incompetency with a retruded profile (Figure 1). She had 5 mm of gummy smile anteriorly and 3mm posteriorly. The intra-oral exam (Figure 2) showed a CI II of 6 mm on the right molar and canine and a CI II of 5 mm on the left side. The overjet was 8 mm.

The upper midline was deviated 1 mm to the right. The patient did not suffer from any TMJ disorder. OPG was normal (Figure 3). The Cephalometric study (Table 1) showed a severe skeletal CI II with ANB=+10°, and a severely retruded mandible with SNB=74°. She was hyperdivergent with FMA=31° and a postero-anterior facial index of 0.65. The upper incisors were protruded with IFPA=115° and the lower incisors were severely protruded with FMIA = 50° and IMPA = 99°. The dental casts are shown in figure 4.

Measures	Normal Values	Initial measurements
FMIA	67 ± 3	50
FX. Lk	25 ± 3	31
DOA	88 ± 3	99
IFPA	107 ± 3	115
SNA	82	84
SNB	80	74
AN B	2 ± 2	+10
AoBo	2 mm ± 2	+9
Occl P	10	13
Z Angle	75 ± 5	56
Post Facial Height	45 mm	42
Ant Facial Height	65 mm	65
Post Ant Index	0.70	0.65

Table 1: Initial cephalometric values. Note in red the abnormal values.



Figure 2: Initial intra-oral pictures of the patient.

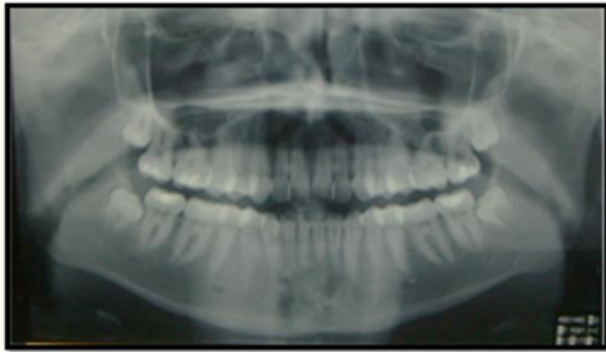


Figure 3a



Figure 3b



Figure 3c

Figure 3: Initial radiographic records.

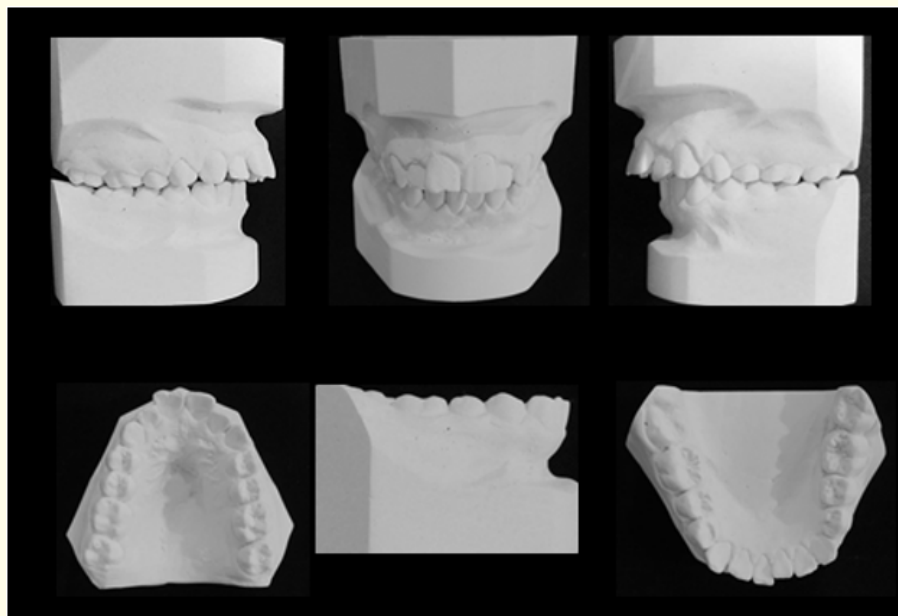


Figure 4: Initial casts of patient.

The patient had a severe high-angle skeletal CI II with gummy smile. She was highly motivated to receiving an orthodontic treatment.

Treatment objectives

The ideal objectives of the orthodontic treatment, independently from the patient's health conditions, are listed below:

1. Correction of the skeletal and dental CI II;
2. Vertical control of the posterior alveolar growth in the maxilla, inducing counter-clockwise rotation of the mandible and enhancement of patient's profile;
3. Correction of the anterior and posterior gummy smile;
4. Solving of the crowding in the upper and lower arches.

It was decided to start with an interceptive testing phase in order to study the oral reaction of the patient to orthodontic treatment. If ulcerations were clinically limited, and the patients considered compliant, comprehensive treatment would then be initiated.

Interception and testing phase

We decided to use a high-pull headgear for vertical control, and then reevaluate the oral reaction to the placement of bands, and the efficiency of the treatment after 6 months. During this time the patient was seen every month. The progress was slow, although

the patient was very compliant and wore the headgear more than 14 hours a day. After 6 months, the CI II was 5 mm on the right molar and 4 mm on the left molar. No oral lesions were specifically reported around the upper molar region where the bands were placed. It was then decided to start the orthodontic treatment due to continuous solicitation of the patient and her parents.

Treatment plan: Comprehensive Orthodontic treatment

Plan	Strategy	Mechanotherapy
Extraction 14,24	Maximal anchorage	Posterior TADs between upper 15-16 and 25-26
Extraction 35,45	Moderate anchorage	Closing loops
Correction of gummy smile	Posterior and anterior impaction	Posterior and Anterior TADs + TPA

Table

Treatment alternatives

1. Orthognathic surgery: wait until the patient reached skeletal maturity. Perform sagittal split of the mandible and impaction of the maxilla;
2. Comprehensive treatment with genioplasty;
3. Forgo orthodontic treatment.

Evaluation of treatment risk:

1. Oral flaring of the ulcerations triggered by orthodontic appliances;
2. Low immunity due to immunosuppressant agents therapy:
 - a. Might lead to TADs failure because of impaired healing. This can be countered by proper prophylaxis;
 - b. Formally contraindicates Orthognathic surgery;
 - c. Formally contraindicates genioplasty.
3. Low generalised bone density: Since a normal density of the jaws was reported, there was no added risk to the orthodontic treatment, specifically the use of TADs.

Treatment of choice:

The patient was very excited and persistent about receiving orthodontic treatment. We explained to the parents the possibility of an oral flaring of the disease triggered by the orthodontic appliance. The patient and her parents fully acknowledged the risks and difficulty of the case but decided to undergo the treatment even if the results were not guaranteed and hazardous. We then decided to proceed with the comprehensive Orthodontic treatment.

Treatment progress

The first phase of treatment: Bonding of upper arch, and vertical control of posterior alveolar growth

After bonding the upper arch, 2 mini-screws were placed between the upper 2nd premolar and upper first molar on both sides. The mini-screws helped control the posterior vertical alveolar growth from the beginning of the treatment and replaced the high-pull headgear. 0.012 mm ligatures were used on light NiTi wires and were tied from the TADs to the upper 5 and 6 on each side.

Patient's reaction

The patient reacted well to the first phase, and a light flaring of the disease had appeared around the gingival buccal mucosa of the upper lip. Also, she had developed gingival hyperplasia that may be due to poor oral hygiene. The patient and her parents were happy and no complaint was registered, which was encouraging for us. We then decided to proceed with the treatment after insisting on excellent oral hygiene. Professional scaling was done every 2 to 3 months with the periodontist at the clinic who had followed the patient throughout her orthodontic treatment.

The second phase: Anterior and posterior impaction in the upper arch, lower arch alignment

The periodontist was asked to place two additional TADs between the upper incisors and laterals. However, initial stability couldn't be established. We then decided to place the TADs between the upper laterals and canines. The procedure was successful. A power chain was placed anteriorly from the TADs to the 19*25 SS archwire to correct the anterior gummy smile (Figure 5 and 6). Posteriorly, the 0.012 mm ligatures were replaced with active power chains that were tied from the archwire to the posterior TADs. Impaction was necessary to obtain a counter-clockwise rotation of the mandible which would enhance the patient's profile. A TPA was used to control the torque on the first molars and to maintain the transversal dimension. On the other hand, the lower arch was bonded and a 0.014 NiTi wire was placed.



Figure 5: Extra-oral pictures of the patient at second phase: posterior and anterior impaction in the upper arch with TADs; lower arch alignment.

Patient's reaction

On the next appointment, painful ulcerations on the gingival buccal mucosa of the lower lip were noted. To our surprise, the patient didn't complain. She considered the oral manifestations of CD as "expected". The ulcerations were deep, generalized and had started a couple of days after bonding. They were difficult to heal even with the application of different kinds of topical gels and sprays and lasted for almost one month. The patient had reported the problem to her physician who considered the flaring of the oral manifestations of the CD as normal and a direct consequence of orthodontic treatment. On the other side, oral hygiene was good and gingival hyperplasia stable.



Figure 6: Intra-oral pictures of the patient at second phase.



Figure 7: Extra-oral pictures of the patient at fourth phase: Space closure in the upper and lower arches.

The third phase: space closure in the upper arch; anterior impaction

The upper first premolars were extracted. Posterior anchorage was maintained through TADs. We tried to do en masse retraction using a Ni-Ti spring that was pulled from a hook crimped distal to the canines to the first molars. Anterior impaction was maintained until gummy smile was fully corrected and was then stabilized using 0.012mm ligatures.

Patient's reaction

The patient came to the clinic after one week complaining of ulcerations in the labial mucosa of the upper lips and cheeks, opposite to the springs that were used for anterior retraction.

Modification of strategy

The decision was made to remove the crimpable hooks and to close the spaces sequentially. The canine retraction was done using a Ni-Ti closed coil that was pulled directly from the upper canines to the first molars. Posterior anchorage was maintained with the TADs.

The fourth phase: Space closure in upper and lower arches

Closing loops were used to retract the anterior teeth in the maxilla. Maximal anchorage was provided with posterior TADs. A closing loop was used in the lower arch to close 2nd premolar extraction spaces (Figure 7 and 8).



Figure 8: Intra-oral pictures of the patient at fourth phase.

Patient's reaction

Throughout the third phase, that took almost 7 months the patient suffered twice from oral ulcerations that could not be associated with any specific orthodontic accessory.

The final phase: Debonding, and follow-up

The patient, who was happy with the enhancement of her smile and profile, did not want to proceed furthermore with the treatment, although we had explained that the occlusal objectives were not fully obtained, as the Cl II was fully corrected on the left side but only partially corrected on the right side. We then proceeded with

the debonding after placing a canine to canine bonded retainer on the lower arch and a wrap-around retainer in the maxilla (Figure 9 and 10). Treatment duration was 4 years. 2 weeks after debonding, the gingival health was assessed by the periodontist. The gingival hyperplasia had healed but a gingival recontouring on the upper anterior teeth was necessary to enhance the smile. The patient did not accept to undergo this intervention. She was very happy with the results of treatment that had "exceeded her expectations". One month after debonding, the patient was contacted for follow-up. She had not suffered from any oral ulceration since debonding.



Figure 9: Extra-oral pictures of the patient at end of treatment.

Treatment results

1. Skeletal CI II was still present with amelioration of 2 degrees of SNB angle (Table 2).
2. Vertical control was achieved with a clear reduction of FMA from 31° to 27°. Also, the occlusal plane angle showed a decrease of 8°.
3. Root resorption of grade 3 of Malmgren [13] (between 2 mm and a third of the original length) was noted on the final OPG (Figure 11).
4. Gummy smile was corrected anteriorly and posteriorly (Figure 9).
5. Patient's profile was enhanced (Figure 9). This is demonstrated by a reduction of Z Angle from 56° to 79° (Table 2).
6. Dental CI II was fully corrected on the left side. A CI II of 3 mm remained on the right side. Upper midline was deviated 1.5 mm to the right (Figures 10 and 12).
7. Crowding was resolved in both arches.



Figure 10: Intra-oral pictures of the patient at end of treatment.



Figure 11a



Figure 11b



Figure 11c

Figure 11: Radiographic records at end of treatment.

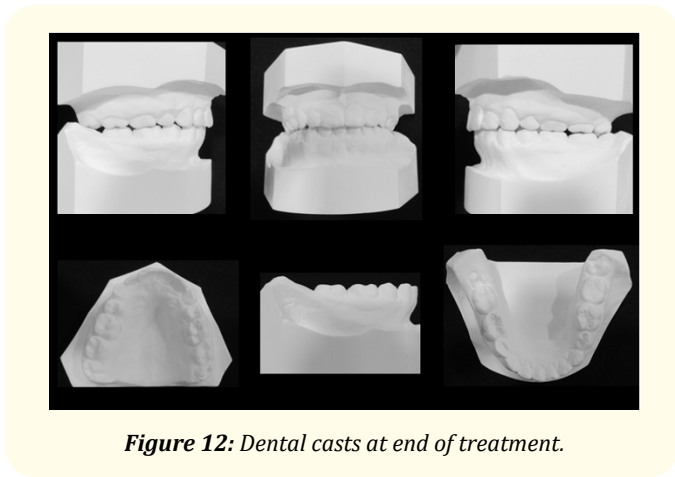


Figure 12: Dental casts at end of treatment.



Figure 13: Comparison of extra-oral pictures of the patient before receiving orthodontic treatment (upper from left to right) and after treatment (below from left to right).

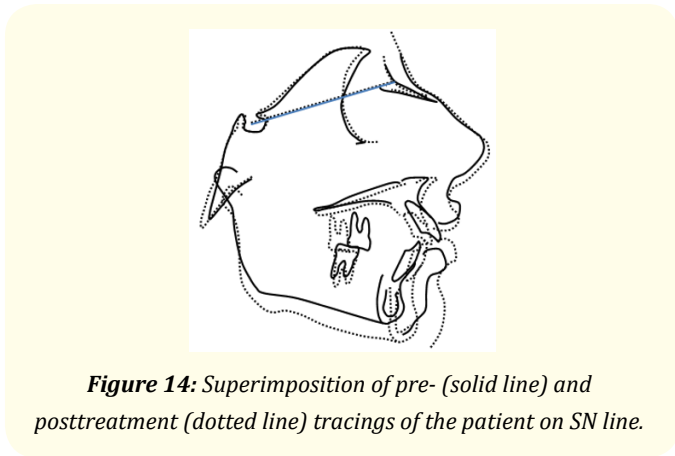


Figure 14: Superimposition of pre- (solid line) and posttreatment (dotted line) tracings of the patient on SN line.

Measures	Normal Venn	Initial measurements	End of treatment measurements
FMIA	67 ± 3	50	56
FMA	25 ± 3	31	27
IMPA	88 ± 3	99	97
IFPA	107 ± 3	115	119
SNA	82	84	84
SNB	80	74	76
ANB	2 ± 2	+10	+8
AoBo	2 mm ± 2	+9	+7
Occ1 P	10	13	5
Z angle	75 ± 5	56	79
Post Facial Height	45 mm	42	39
Ant Facial Height	65 mm	65	52
Post Ant Index	0.70	0.65	0.75

Table 2: Comparison of the cephalometric values at start and end of treatment. Note in red the abnormal values. Note in green the cephalometric measurements that were improved during orthodontic treatment.

Discussion

Crohn's disease is an auto-immune disease that has no curative treatment. Continuous research is being done to improve the patient's life, but the information is still poor. To date, no standard protocol describing the orthodontic treatment of patients with CD has been established. Although it can be very challenging, the outcome of the orthodontic treatment may help patients feel better as the physical and an emotional distress caused by CD are severe, especially in Lebanon, where it was proven that the psychological burden of the disease was heavy [9], with a serious lack of proper social support groups and associations. More so, adolescents specifically, adjust very badly to CD because it seems to impede their independence, as they find themselves relying on their family, care providers, and therapy at a very delicate phase of their lives which is puberty.

Our patient, an adolescent, came to our offices, seeking orthodontic treatment to improve her smile and face, therefore her well-being. She needed to feel "normal". This incentive kept her

going through the orthodontic treatment even during severe oral breakouts of the disease. It is important to highlight that the patient had not suffered from any systemic or oral manifestations of CD, ever since she had started treatment with the immunosuppressant agents (Imuran®). But the oral ulcers that had been triggered by the orthodontic treatment were a constant and painful reminder of a disease that had molded her life.

Patients with CD are often treated with anti-inflammatory drugs, corticosteroids or immunosuppressant agents that are administered as soon as the patient is diagnosed and continued throughout life [8,10,14]. Other drugs such as Infliximab have also been used and reported to having significantly improved patients symptoms [14]. Our patient had been taking Imuran since she was 13 years old, thus, 3 years before the start of the orthodontic treatment, and had not suffered since from any systemic or oral manifestation of CD. Imuran®, whose generic name is Azathioprine, is an immunosuppressive drug used for transplantations and treatment of auto-immune diseases such as CD and ulcerative colitis [15,16]. It has many side effects such as low immunity, susceptibility to infections, anaemia, acute pancreatitis, and risk of lymphoma [16]. This explains why our patient was regularly monitored by her physician at 6 months intervals with full-body exams including blood tests, urology exams, ultrasound, endoscopy and radiography, as a way to follow the side effects of the medication and the progress of the disease.

Oral lesions of Crohn's disease have been associated with an iron deficiency that may be due to reduced absorption of vitamins that accompanies diarrhea [17]. In our case, the patient had not suffered from diarrhea since she had started therapy, and the oral lesions that had disappeared with the use of Azathioprine, were concluded to be a direct solicitation of the orthodontic treatment. This was also demonstrated by Högberg [12] who has experienced 2 children who were only diagnosed with CD after having oral outbreaks once orthodontic treatment had been initiated. Therefore, the author concluded that braces can certainly trigger oral lesions in CD by mechanical, traumatic effect, or by intolerance to the material of the bracket itself.

However, successful results can be obtained in patients with CD through orthodontic treatment. In our case, most clinical objectives were met at end of treatment even though the case was difficult as the patient presented a severe skeletal CI II with gummy smile that required 4 premolar extractions and the use of

4 TADs. This can be demonstrated with the enhancement of the patient's smile and profile (Figure 13). The superposition of the initial and final cephalometric tracings on SN line (Figure 14) and the maxillary and mandibular structures (Figure 15) show that the vertical dimension was controlled and a counter-clockwise rotation was achieved. This proves that complex mechanics can be used in patients with CD. Therefore, Crohn's disease should not be considered as a formal contraindication to comprehensive orthodontic treatment.

On the other hand, the selection of the appliances used in our patient was crucial to the progress of treatment and necessary to control the manifestation of the disease. The orthodontic treatment had triggered frequent episodes of oral ulcerations, and the patient reported deep, painful, and difficult to heal oral ulcerations that had appeared every 2 to 3 months and took almost a full month to heal. Deep ulcerations had formed around springs and hooks. Hence, it is advisable to avoid using such accessories in patients with CD and to restrict the selection of tools that are distant from the labial mucosa such as power chains. These controls will aid in the achievement of the orthodontic objectives. It is also recommended to implement good oral hygiene and to undergo regular professional scaling at 6 months intervals or less to control the factors that might impede the healing of the oral lesions.

Concerning treatment duration, the continuous alterations to the mechanotherapy and the delay in the extractions because of the imminent fear of treatment interruption might have prolonged the treatment duration that took almost 4 years. Immunosuppressant agents have been incriminated in changing the bone metabolism which influences tooth movement and duration of orthodontic treatment. However, it is important to know that the most frequently used immunosuppressant agents can be divided to 2 types: those that alter cytokine synthesis such as glucocorticoids and cyclosporin-CsA, and those that alter nucleotide synthesis such as Azathioprine [18]. A clear correlation has been proven between the first category of immunosuppressant and the duration of orthodontic treatment. However, Azathioprine therapy has shown no effect on bone metabolism [19]. Therefore, the available data suggests that immunosuppressant therapy in our patient cannot be considered as an influencing factor to the prolongation of treatment time. More research should be done in order to determine the relationship between CD and the factors influencing the orthodontic treatment duration.

On the other hand, severe root resorption of Malmgren grade 3 has been noted on the final OPG. An evaluation of the roots through CBCT is important for better diagnosis but the patient didn't accept to undergo further exams. A correlation between root resorption and intrusion has been described in the literature [20,21]. More recently, it was proven that the use of anterior mini-implants to support incisor intrusion increased the rate of root resorption due to the greater amount of true vertical force exerted on the 4 incisors [22]. On the other hand, the use of certain drugs has been incriminated in increasing the risk of developing root resorption [23], however, the correlation between Azathioprine and root resorption has not been investigated to date. Careful monitoring of patients undergoing drug therapy is suggested during mini-implants supported anterior intrusion.

Although the dental objectives had not been fully met, the patient was highly satisfied with the treatment results that had exceeded her expectations and had changed the way she felt about herself. Patient's feedback is an important tool to assess the success of treatment in patients with CD, and any other chronic illness.

Conclusion

Crohn's disease cannot be perceived as a formal contraindication to orthodontic treatment. Even though the treatment is challenging and hazardous, it can help some patients, especially adolescents, in their physical and emotional well-being. However, many factors should be carefully considered when making clinical decisions:

1. Selection of the patient: the patient should be highly motivated to receiving orthodontic treatment and should persist on treatment even after full explanation of the risk of outbreak of the oral lesions.
2. CD therapy can be a limiting factor to orthodontic treatment, acting directly on bone remodeling or indirectly by suppressing the immunity.
3. Selection of appliances: hooks, springs and any other of accessory that may impinge the buccal mucosa are contraindicated.
4. Implementation of good oral hygiene and regular professional scaling is important to control the external factors that might delay the healing of the oral lesions.

5. Treatment time can be prolonged in patients with CD.
6. Regular root monitoring of patient undergoing drug therapy is recommended during high-risk movements such as anterior intrusion using TADs.
7. Patient's satisfaction is an important tool to assess the success of treatment in patients with CD.

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