

Treatment of Skeletal CL II Patient with Maximum Lower Incisor Protrusion and Minimum Overjet with Rahhal Functional Appliance

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Abstract

Treatment of skeletal CL II includes functional orthopedic treatment, head-gears, extraction of the upper premolars and orthognathic surgery. To treat any patient with functional appliances (bite jumping) an adequate overjet is necessary. In this case an 11 years old female patient has skeletal CLII due to mandibular deficiency with ANB angle 8 degrees, overbite: 3 mm, overjet: 1 mm, extremely convex profile and underdeveloped chin due to the hyper muscle contraction of the lower lip to obtain oral seal. To obtain an adequate overjet lower first premolars were extracted and maximum retraction using mini screws (for maximum anchorage) was applied. Afterwards Rahhal functional appliance was used by the patient 16 hours a day for 6 months and 10 hours a day for another 6 months for retention. After that fixed orthodontic treatment was completed. Lateral cephalometrics were taken, traced and analyzed. In the result Skeletal CLI was obtained (ANB 4 degree), straight facial profile, normal over bite overjet and particular chin development were noticed. As a conclusion, in skeletal CLII malocclusions, lower incisor protrusion will cause a contraindication for functional treatment. Extraction of the lower premolars and retraction of the lower incisors followed by functional orthopedic treatment is an efficient method to treat these cases instead of waiting for orthognathic surgery, also reducing the muscle pressure on the chin will change the development characteristics of it.

Keywords

Rahhal Functional Appliance, Lower Incisor Protrusion, Minimum Overjet, Maximum Anchorage, Chin Development

1. Introduction

Functional appliances have been used for over a century in the treatment of Class II patients [1]. Functional appliances can be removable or fixed [2]. The main objective of therapy with functional appliances is to induce supplementary lengthening of the mandible by stimulating increased growth at the condylar cartilage [2]. It has been demonstrated that the effectiveness of the functional treatment of mandibular growth deficiencies strongly depends on the biological responsiveness of the condylar cartilage, which in turn is associated with the growth rate of the mandible [3].

The stimulation of mandibular growth, distal movement of the upper dentition, and mesial movement of the lower dentition contribute to the correction of Class II malocclusion with the use of fixed functional appliances. Generally speaking the fixed functional appliances like Herbst, jasper jumper, and Forsus skeletal effects are less than the skeletal effects of the removable functional appliances. To treat any patient with functional appliances an adequate overjet is necessary for bite jumping. Severely protruded lower incisors might cause contraindication for functional orthopedic treatment [4].

The following is a case report of mandibular deficiency treatment in 11 years old female patient with skeletal CLII with overjet: 1 mm, severely protruded lower incisors, extremely convex profile and underdeveloped chin due to the hyper muscle contraction of the lower lip (to obtain oral seal).

2. Case Report

An 11-year-old female in her mixed dentition is presented with the chief complaint of severe convex profile and retruded lower jaw. As mentioned before the patient had a chin deficiency with hyperactive lower lip. There was no facial asymmetry with shallow mentolabial fold (**Figure 1**).

Intraorally she was in the late mixed dentition stage, the hygiene was fair, and midline was coinciding. The upper right canine and left lateral incisor were in cross bite.

Angle classification was Class I. The overjet was 1 mm, whereas the overbite was 3 mm. The panoramic radiograph confirmed the presence of all permanent teeth including the developing third molars (**Figure 2**). In the cephalometric assessment (**Figure 3**), the ANB value of 8° suggested a severe Class II skeletal pattern. SN to mandibular plane angle had increased. The upper incisors were normal and the lower incisors were severely protruded (lower incisor-NB = 14 mm). The patient was 11 years old, in the prepubertal stage.



Figure 1. Pretreatment intraoral & extraoral photographs of the patient.

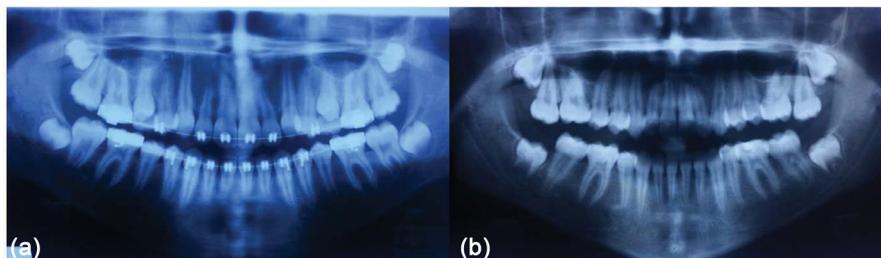


Figure 2. Panoramic X-rays of the patient, (a) at the beginning of the treatment, (b) at the end of the treatment.



Figure 3. Lateral cephalometric X-rays of the patient. (a) Before treatment; (b) After retraction of the lower incisors; (c) After functional treatment; (d) After retention period.

Possible treatment alternatives are as follows:

- 1) Do simple orthodontic treatment with fixed appliance to resolve the cross bite in the upper right canine and left lateral incisor area and do leveling and alignment without interfering the skeletal problem, which is not acceptable by the patient because her main problem was the severe convex profile.
- 2) Extracting four unit premolars was not considered, because the upper incisors were in normal position. And again that will not solve the chief complaint of the patient (convex profile).
- 3) Orthognathic surgery to the mandible after adulthood.
- 4) Extract tow lower premolars, Retract the lower incisors to the normal position and do functional orthopedic treatment.

After a thorough analysis of the case and long discussion with the family of treatment options we decided to go to functional orthopedic treatment. Specially that the patient was still in the prepubertal stage, which will give us enough time to extract and retract the lower incisors. It has been demonstrated that the effectiveness of the functional treatment of mandibular growth deficiencies strongly depends on the biological responsiveness of the condylar cartilage, which in turn is associated with the growth rate of the mandible [3]. The rate of mandibular growth, however, is not constant throughout the juvenile and adolescent periods, with the existence of a pubertal peak in mandibular growth described in classical cephalometric studies [5]-[10]. The onset, duration, and intensity of this pubertal spurt in mandibular growth vary on an individual basis. Most of the literatures mentioned that one of the main indications of skeletal maturity marking the end of growth in females is menarche [3].

The patient and the family were aware that if the patient is not cooperative in using the functional appliance then she will undergo orthognathic surgery.

3. Treatment Method

The treatment plan consisted of three phases:

1) To do functional treatment an adequate overjet should be obtained. For this purpose lower first premolars were extracted and maximum retraction using mini screws (for maximum anchorage) were applied (**Figure 4**).

2) To obtain skeletal CLI relationship, Rahhal functional appliance (modified bionator) [11] was used by the patient 16 hours a day for 6 months and 10 hours a day for another 6 months (**Figure 5**).

3) After that fixed orthodontic treatment was completed to obtain normal overbite and overjet and relevel the upper and lower arch.

Lateral cephalometrics were taken, traced and analyzed on the following dates: before the treatment, after the retraction of the lower premolars and before functional treatment, after functional treatment, after fixed orthodontic appliance and after 3 years of retention.

In the first phase of the treatment we bonded 0.018 in ROTH prescription brackets on the lower and upper arch in order to align the teeth. Alignment was achieved with the use of NiTi wires, followed by stainless steel (SS) wires. Three months after the alignment phase has started, we extracted the lower right & left first premolars and started lower incisor retraction using miniscrew which were placed between the first molar and the second premolar to obtain maximum retraction of the lower incisors. After six months the retraction was completed, we took impression for the Rahhal Functional appliance which is a modified bionator



Figure 4. Intraoral & extraoral photographs of the patient during retraction of the lower incisors with mini screws.



Figure 5. Rahhal functional appliance (modified bionator).

appliance (was modified by the author 14 years ago).

Rahhal Functional Appliance (Figure 5):

The appliance is a modification of the original bionator and monoblock appliances. Comparing to the bionator appliance the palatal and lingual arches were replaced with acrylic to acquire maximum skeletal anchorage of the mandibular lingual bone and maximum anchorage from the palatal side, which is expected to produce a more skeletal effect. Comparing to the monoblock the acrylics between the lower and upper anterior teeth was relieved and removed to allow a better breathing and speaking to the patients, which is expected to increase the cooperation of the patients, also the acrylic covering the lower anterior teeth was replaced with labial bow to minimize the protrusion in the lower incisors (Figure 5).

The patient was asked to wear the appliance sixteen hour a day. It took 6 months to achieve CLI skeletal relationship, the molar relationship was CLIII and the canine relationship was CLI. Since then, the patient was asked to use the appliance at night for another 6 months for retention. At this stage lateral cephalometric image clearly showed mandibular growth. The third phase of the treatment was performed by discontinuing the appliance and continues with fixed appliance. In this phase, we did not use any other Class II correction mechanics such as Class II correcting elastics. Retention was achieved with Hawley appliance for both maxillary and mandibular arch.

Having finished phase III, treatment objectives were met: profile convexity which was the chief complaint of the patient improved clearly. Chin has developed very well enhancing the profile outline. CLIII molar and CLI canine relationship with desirable overjet and overbite were achieved. The skeletal effects and increasing of mandibular length were evident.

4. Discussion

In a functional treatment, a symmetrical overjet and possibility of advancing mandible without any interference is a critical issue [4]. In our case the overjet was 1 mm and the lower incisor-NB was 14 mm which were a limitation for bite jumping. To obtain an adequate overjet maximum retraction of the protruded lower incisors was necessary. We extracted the lower first premolars and retracted them using miniscrews placed between lower second premolar and first molar. The treatment applied included fixed orthodontic appliances for maxillary and mandibular arch after wards treatment with functional appliance was launched.

Treatment with functional appliances has several well-established advantages. In this case functional appliance treatment caused reducing overjet, patient's profile improvement, chin development and taking care of jaw discrepancies [1]. The selection of functional appliances is dependent upon several factors which can be categorized into the patient factors, for example, age and compliance, and clinical factors, for example, preference/familiarity and laboratory facilities [12]

[13]. The Rahhal functional appliance was modified from bionator and monoblock by the author 14 years ago [11]. It offers better skeletal anchorage comparing to bionator, but less acrylic mass comparing to monoblock, better breathing possibility and less lower incisor proclination.

At the end of the treatment, patient's profile was noticeably improved with favorable treatment effects in cephalo-metric analysis. SNB was increased by 4° while ANB had reduced by 4°, SNA remained the same (Table 1).

After treatment the canines relationship was Angle CLI relationship while the molars were Angle Class III, overjet was normal. Also the chin developed significantly which might be due the reduction in the muscle pressure on it which enhanced the profile significantly. Patient was satisfied with the results with her self-esteem being significantly improved. Retention was maintained with Hawley appliances for maxillary and mandibular arches. Arrangement was then made to visit the patient regularly during the retention phase of treatment (Figure 6). The patient was instructed to wear the retainers for as long as required to ensure stability [14] [15].

5. Conclusion

In skeletal CLII malocclusions, lower incisor protrusion will cause a contraindication for functional treatment. Extraction of the lower premolars and retraction of the lower incisors followed by functional orthopedic treatment is an efficient method to treat these cases instead of waiting for orthognathic surgery. Also functional orthopedic treatment is an efficient way to reduce the muscle pressure on the chin which will change the development characteristics of it and enhance the profile significantly.

Table 1. Cephalometric readings of the patient.

Value	Pretreatment	After Extraction	After Functional	Post Retention
SNA	83	85	84	83
SNB	75	78	80	79
ANB	8	7	4	4
GoGn-SN	45	38	39	40
1-NA	4	3	2	3
1-NB	14	5	6	6
Pg-NB	0	1	2	3
Upperlip-S line	4	2	0	0
Lowerlip S line	6	0	0	0



Figure 6. Postretention intraoral & extraoral photographs of the patient.

Conflicts of Interest

The author declares that he has no conflicts of interest.

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