CASE REPORT

A two stage non extraction treatment of class II division 1 malocclusion using split-activator and fixed appliance – A case report

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Received 28 December 2014; revised 12 April 2015; accepted 13 April 2015
Available online 1 May 2015

KEYWORDS
Activator;
Class II malocclusion;
Functional appliance

Abstract
Class II malocclusions are one of the most common problems in orthodontic treatment. There are a variety of effective and simple treatments to correct them, such as headgear and functional appliances. Functional appliances are commonly used for the treatment of class II malocclusions with mandibular deficiency. The success of treatment with a functional appliance relies on the patient’s cooperation and favourable mandibular growth. Treatment with a functional appliance usually lasts for 9–12 months and requires a proper retention time to ensure complete musculoskeletal adaptation.

A second stage of treatment with a full-fixed appliance is often required to achieve proper alignment and good interdigititation of the dentition. In the present case, a prepubertal twelve year female with a class II malocclusion and retrusive mandible was treated first with an activator for 17 months. The activator successfully resolved the problem of the retrusive mandible with favourable mandibular growth. This was followed by 10 months of fixed orthodontic treatment to finalize the occlusion without extractions. This two phase treatment yielded a pleasing profile and good occlusion in this patient.

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1. Introduction

Class II malocclusions are one of the most common problems seen by an orthodontist. In growing patients, two-phase treatment of class II skeletal malocclusions, which includes growth modification with functional appliances followed by orthodontic treatment with fixed appliances, has been advocated as an appropriate treatment approach.\(^1,2\) As with all orthodontic treatment modalities, the primary goals of growth
modification are both to correct the skeletal discrepancy and to achieve optimal facial aesthetics.

Several important benefits have been attributed to the treatment of class II malocclusion at an early date: prevention of trauma to the maxillary incisors associated with large overjet, interception of developing dysfunction, psychological advantages for the child during an important formative period of life, and improved prognosis for the adolescent phase of treatment.  

2. Background

According to McNamara the most frequent skeletal problem in class II malocclusion in preadolescents is mandibular retrognathia.  

Hence, any appliance that demonstrates the ability to stimulate significant mandibular growth would be an important asset to a clinician’s armamentarium. Animal studies have demonstrated that appliances which position the mandible anteriorly can stimulate significant mandibular growth, primarily by enhanced remodelling response at the condylar region. The purpose of functional therapy is to change the functional environment of the dentition to promote normal function. Most of the functional appliances are designed to enhance the forward growth of the mandible by encouraging a functional displacement of the mandibular condyles downward and forward in the glenoid fossa. This is balanced by an upward and backward pull in the muscles supporting the mandible. Adaptive remodelling may occur on both articular surfaces of the temporomandibular joint to improve the position of the mandible relative to the maxilla.

Two of the most widely used functional appliances for orthopaedic correction of class II skeletal malocclusions used functional appliances are the activator and the twin block. The skeletal and dentoalveolar effects of activators have been well documented.

The activator and its successors provide a greater contact area with the mandibular teeth and lingual mucosa and thus are more effective in stimulating the patient to position the mandible forward constantly. In addition to modification of jaw growth, the effects of an activator also include proclination of the lower incisors and retroclination of the upper incisors resulting in a decrease in the overjet. The activator loads the lingual surfaces of the lower incisors and can procline them gradually because of the reciprocal intermaxillary traction while the patient occludes into the construction bite. Dental movement can be used to our advantage in treatment if the lower incisors have been retroclined and the upper incisors proclined due to lip habits often seen in individuals with an increased overjet. The acrylic framework of the activator provides contact with all teeth and the erupting posterior teeth can be redirected mesially or distally with selective grinding of the acrylic framework. Despite its simple design, an activator can be used to change the dental relationship in all three planes of space with proper adjustment.

Another popular functional appliance is the Twin Block. Due to its simple design and ease of use, the TB can be worn 24 h a day and takes full advantage of all the functional forces applied to the dentition, including those of mastication. Another advantage of the TB is that it can be used with fixed appliances.

3. History, clinical findings and diagnosis

A 12 year pre-pubertal female patient presented to the Department of Orthodontics, SDM college of Dental Sciences and Hospital, Dharwad, with the chief complaint of forwardly placed front teeth. Examination of the case was carried out following a standardized protocol followed at the department and summarized herein:

3.1. Extra oral examination Fig. 1(a–d)

(a) Frontal view
   i) Facial symmetry: Apparently symmetrical
   ii) Facial thirds: Proportional
   iii) Incisor exposure: 4 mm at rest

(b) Profile view
   i) Facial profile: Convex
   ii) Lip protrusion: Protruded with lower lip trap
   iii) Chin: Receding

3.2. Intra oral examination Fig. 2(a–c)

(a) Teeth present:

   7 6 5 4 3 2 1
   6 5 4 3 2 1
   1 2 3 4 5 6 7

(b) Molar relationship: End on bilaterally
(c) Canine relationship: End on bilaterally

Figure 1 Pretreatment extraoral picture.
3.3. Habits

(a) Sucking on lower lip
(b) Simple tongue thrust

3.4. Radiological findings: Table 1

(a) Skeletal sagittal class II with normal divergent jaw bases and proclined upper and lower incisors.
(b) MP3 (growth status): F stage

3.5. Visual treatment objective (VTO)

Positive

3.6. Diagnosis

Angle’s class II (end on) division 1 malocclusion on a skeletal class II normal divergent jaw bases with the presence of simple tongue thrust and lower lip sucking habit.

3.7. Treatment plan

Considering the skeletal and dental discrepancy two treatment approaches were thought appropriate:

1. Functional appliance to correct the underlying skeletal discrepancy followed by fixed mechanotherapy for final detailing.
2. Upper first premolar extraction and dental camouflage.

The two phase treatment plan was deemed more appropriate for this case and the patient’s parent consented for this plan understanding the cost benefit ratio being, the possibility of correction of skeletal discrepancy and possibility to treat by non extraction. However, with an increased treatment timing and extra cost involved. The positive VTO was the best motivation for the parents to opt for this plan.

3.8. Phase I treatment: functional appliance therapy

3.8.1. Appliance selection

A twin block with headgear or twin block alone versus activator. A twin block with headgear was the first choice as it provided the comfort of function, the advancement of mandible, restriction of maxillary growth. However, was not used due to multiple concerns of the parent’s being:

(a) The patient was a hosteller so would not be under their supervision for proper headgear use.
(b) Children might tease her, fight during play which might cause her injury.
(c) They will not be immediately available to attend to her in event of any unforeseen happening and teachers at the school might be of little help in handling such a scenario.
(d) Appointment scheduling was to be kept to minimal as the parents went to see the child just over the weekend and school was far so closely placed appointments would entail missing the school frequently.

Considering the aforementioned concerns an appliance was sought that was easy to use, sturdy enough not to break easily or distort with a bit of rough handling, need minimal scheduling. An activator was zeroed as the appliance of choice for this case because:

(a) Very easy to use
(b) Sturdy
(c) Appointments spaced apart
(d) Could easily be removed during play or during class minimizing the danger of injury or discomfort during speech. Besides, unlike twin block which has an upper and lower block, activator is a single piece appliance which further minimizes the chance of patient losing one member and defeating the purpose of treatment.
(e) Lastly, the effects of activator and twin block treatment have been documented to be similar.
3.9. Design and construction: Fig. 3

A vertical height of 5 mm in the premolar region and advancement of 7 mm was planned. Since, the advancement of mandible resulted in a cross bite an expansion screw was incorporated for transverse maxillary expansion which was to be activated every weekend when the parents went to see the child.

This had three advantages being, firstly, the screw was properly activated as directed, the parents had the chance to observe the appliance regularly so any gross distortions could be detected and the parents were directly involved in their child’s treatment and hence were motivated to continue and encourage the child to cooperate thus minimizing the dropout from the therapy.

The labial bow was split to allow for arch expansion to happen.

3.10. Appliance use and appointment scheduling

Basic appliance care instruction was explained to the patient. She was asked to use the appliance after dinner around 8 pm to 7 am and after coming from classes till going for play in the evening that roughly added another 3 h, amounting to around 14 h a day and any other time when she was free. She was also to wear the appliance full time on all Sundays.

The first two appointments were spaced at a week interval to assess the comfort and compliance of the patient. The patient was extremely cooperative with the appliance use. Thereafter, recall was scheduled at 2 months apart for any adjustments needed and selective grinding of the cusps to redirect the erupting teeth.

3.11. Follow up

Selective grinding of the acrylic framework was performed to allow permanent teeth eruption during phase I treatment. The patient had good compliance and maintained good oral hygiene. The upper arch was expanded to correct buccal cross bite and the space obtained in the anterior segment was to be used later during fixed mechanotherapy for intrusion and retraction that may be needed.

After 1 year and 5 months of phase I treatment, the patient showed an improved facial profile and bilateral super Class I molar and canine relationship. The excessive curve of spee of the lower arch was also levelled by the selective grinding to encourage lower posterior teeth eruption. Figs. 4(a–d) and 5(a–c) show post functional pictures of the patient.

Meanwhile, the patient also attained her menarche towards the end of functional phase.

3.12. Phase II treatment: fixed mechanotherapy

The treatment aims of the early phase treatment were to reduce the overjet and correct the class II molar relationship, while the aim of phase II treatment was to achieve good interdigitation without extractions.

The case was strapped up from first molar to first molar using 0.022 inch slot; metal brackets; Pre adjusted Edgewise Appliance with MBT versatile+™ (3M Unitek, Monrovia, California) prescription and a sequence of 0.014 inch, 0.018 inch and Unitek™ Nitinol Heat-Activated Wire (3M Unitek, Monrovia, California) wires were used for aligning followed by 0.018 inch Australian stainless steel™ (A.J. Wilcock, Victoria, Australia) wire with class II elastics to maintain the occlusion. Stripping of lower anterior to gain about 3 mm space was carried out and the space was used for up-righting and intruding the lower anterior. Final finishing was done with 0.014 inch Australian Stainless steel wire with short class II
elastics. The fixed appliance phase took 10 months to finish. Figs. 6(a–d) and 7(a–c) show post treatment pictures of the patient.

4. Retention

Wrap around retainer with anterior bite plane were given for full time use for 1 year and thereafter night time use for 6 months.

4.1. Critical evaluation of treatment result

Numerous researches have shown that the activator influences the dentoalveolar region predominantly. However, there are some arguments over the orthopaedic effects of the appliance. While some authors claim that the skeletal effect of the activator therapy is attributed to the restrictive of maxillary growth, others hold the opinion that the activator stimulates condylar and as a result the mandible grows. An influence on glenoid fossa remodelling has also been reported by some workers.

In our case however, when treatment changes were compared with pre treatment, post functional and post treatment superimpositions (Fig. 8a and b) a predominance of dentoalveolar changes over skeletal.

The functional phase of therapy took 19 months which was longer than usual. The premise behind this was to allow sufficient time for bone remodelling to occur, besides allowing time for the permanent teeth to erupt. The total duration of the treatment was 29 months which could have been reduced to about 18 months had only fixed mechanotherapy been executed with upper premolar extraction. However, at the cost of losing two healthy teeth; without the benefit of correction of underlying skeletal discrepancy and the habit, which, if persisted could have later led to space opening at the extraction site.

The patient and her parents were satisfied with the treatment result.

5. Conclusion

This case report presents a successful treatment of a class II division 1 case using two phase therapy rightly employing the triad of 3 As in functional appliance therapy: right age, right attitude and right appliance.

A pleasing orthognathic profile was attained with the elimination of lower lip trap with the correction of tongue thrust...
and lip sucking habit. The canine and molar relation was bilaterally class I with midlines matching and overjet of 2 mm and overbite of 3 mm. There was a slight gumminess in the smile, which was aesthetically acceptable considering that the patient may have some residual soft tissue growth remaining which will improve it over time.

Support and conflict of interest

None.

References


