

Case Report – Correction of skeletal class II with The R Appliance a modified functional Skeletal Class II Corrector

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Abstract:

Background: Functional appliances are a primary orthopaedic tool to influence the facial skeleton of the growing child. Class II malocclusion poses a common challenge to the orthodontists for a successful treatment outcome. Functional appliances in skeletal class II are given with retrognathic mandible. To combat the disadvantages of functional appliances for class II correction like vertical growth pattern but good VTO and deep bite, no adjustments or trimming needed for orthodontist, reduction of review interval, patient compliance, combination effect of tooth and tissue borne appliances, and to activate hyperactive perioral muscles which believed to cause no labial tipping of the lower incisors and show good skeletal changes. A new appliance named "The R-appliance" was introduced.

Materials and Methods: A 13-year-old male patient with a chief complaint of forwardly placed upper front teeth. On examination Patient had a dolicocephalic head, Leptoproscopic face, convex profile, posterior divergence, and incompetent lips, cephalometric tracing confirmed that the patient had a moderate Class II skeletal pattern, retrognathic mandible. Average – vertical growth pattern and proclined maxillary and mandibular incisors. The CVMI stage was stage 3, fishman hand wrist radiograph showed stage 3 approaching 4. The bite registration was done in accordance with control of the vertical growth pattern. The patient was asked to wear the appliance full time except on meals in a day. The patient was asked to follow-up every 3 weeks and was instructed to wear the appliance for a period of 6 months.

Results: Following 4 months of treatment, the patient's profile and smile greatly improved due to deep bite reduction and mandibular advancement. Overjet and overbite were improved due to the postural forward positioning of the mandible.

Conclusion: The R appliance is a reliable and effective appliance, is a very patient and orthodontist friendly appliance. This helps achieve good results in less amount of time and maintains the growth pattern.

Key Word: Skeletal class II correction; functional appliances; R appliance.

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I. Introduction

The past 20 years have seen an increasing awareness of the potential of functional appliances as valuable tools in orthodontics. Functional appliances are primary orthopaedic tool to influence the facial skeleton of the growing child in the condylar and sutural areas. Class II malocclusion poses a common challenge to the orthodontists for a successful treatment outcome. Functional appliances in skeletal class II are given with retrognathic mandible. The functional appliances according to proffit can be divided into tooth borne active, tooth borne passive and tissue borne. Different removable functional appliance has been used in growing patients to treat this malocclusion [1]. Several studies have described positive effects with various functional appliances and have focused on their effects on skeletal and dental structures [2].

Functional appliances have shown a significant diversity in design [4]. In spite of the fact that successful treatment of this condition has been proved on many occasions, clinicians and patients continue to

look for simpler and better methods for correcting the occlusion while maintaining or improving the facial appearance. Most functional appliances help to eliminate the cause but does have few disadvantage like, tendency to increase lower facial height , maintaining oral hygiene , not useful in adults patient compliance , adjustment of appliance every month. Some other disadvantages of functional appliances are vertical growth pattern with a high mandibular plane angle, bimaxillary protrusion, severe tongue trust, late grower and bone pathology.

Majority of treatment modalities such as functional appliances are directed toward stopping or redirecting maxillary growth and simultaneously stimulating mandibular growth.[5]

To combat the disadvantages of functional appliances for class II correction like vertical growth patten but good VTO and deep bite, no adjustments or trimming needed for orthodontist, reduction of review interval, patient compliance, combination effect of tooth and tissue borne appliances, and to activate hyperactive perioral muscles which believed to cause no labial tipping of the lower incisors and show good skeletal changes. A new appliance named “The R-appliance” [11]was introduced. It is a combination of Frankel appliance and twin- block appliance and R represents the name of the first author Dr.Rohan Rai for the treatment of Class II division 1 malocclusion.

II. Material And Methods

This case study was carried out on patient of Department of orthodontics at PSM dental college, Kerala, India.

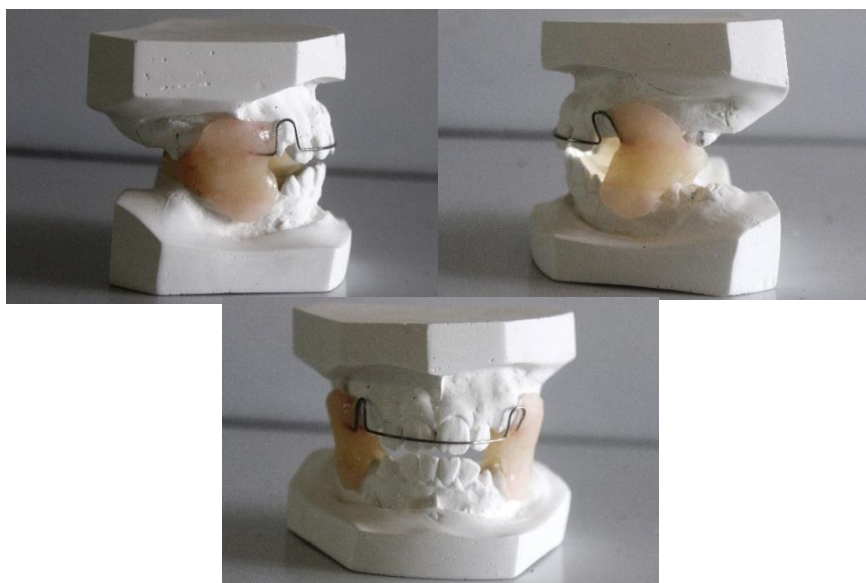
III. Patient Selection

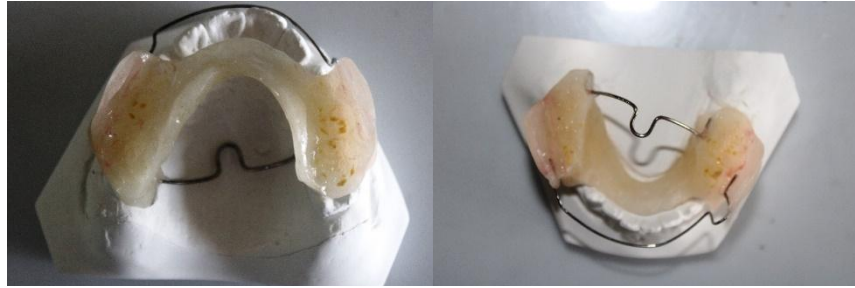
Patient who can be considered for R appliance are those having Class II division 1 dental malocclusion on a moderate skeletal Class II base with abnormal perioral musculature and potential for mandibular growth.

IV. Appliance Design

The appliance is a single acrylic block with 2 parts upper and lower compartment. The design of the appliance is derived from Frankel appliance and twin block. It is based on functional matrix theory in Frankel and for twin- block appliance originated from the servo system theory which has been coalesced in a single appliance. This is combination of the parent appliances which brings about three- dimensional changes desired in skeletal class II cases. The maxillary part of the component has acrylic block covering occlusal surfaces of the first, 2nd pre molars and molars. The inclined block of upper and lower are attached to each other with no inclination and constructed through occlusal surface for mandible in a forward position. A TPA fabricated with a 19 guage wire for anchorage control, 21 guage short labial bow for proclination control .The mandibular part consisted of lingual acrylic baseplate extension for stability and control . The buccal shields prevented the abnormal perioral function. [Figure 1]. The mode of action is similar to conventional twin block

Figure 1 :R appliance. (a) Maxillary (b) mandibular





V. Case Report

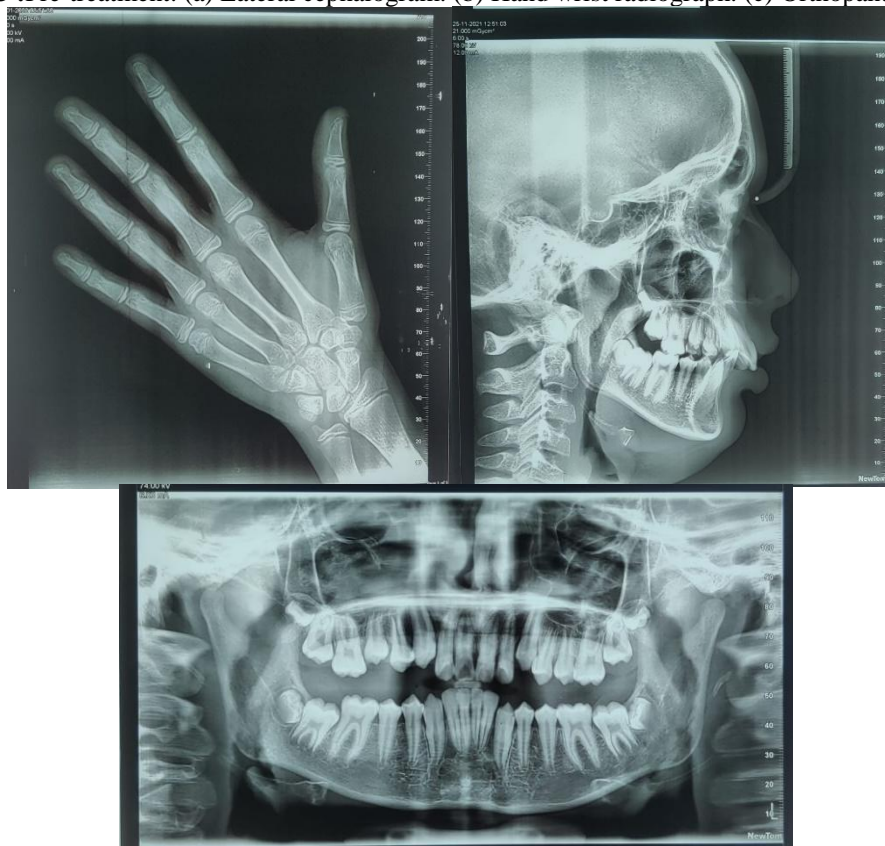
A 13- year- old male patient reported to the department with a chief complaint of forwardly placed upper front teeth. The patient cited esthetics as the main reason for desiring orthodontic treatment. On extraoral examination, physical status was normal. Patient had a dolicocephalic head, Leptoprosopic face, convex profile, posterior divergence, and incompetent lips. The TMJ analysis were also normal the postural rest position and interocclusal clearance was checked by command and direct extra oral method. Functional analysis were assessed and normal regarding swallow, deglutation, tongue and lips. The VTO was positive. The patient displayed 100% upper incisor crown exposure, and a nonconsonant smile arc. Intraoral examination revealed erupting mild crowding in the lower anterior segment. The patient exhibited Class II molar relation bilaterally, over jet of 10 mm and overbite of 9 mm [Figure 2]. Ashley Howe’s analysis showed an increased premolar basal arch width compared to premolar diameter concluding that arch expansion is possible. The cephalometric tracing confirmed that the patient had a moderate Class II skeletal pattern, retrognathic mandible with ANB value of 7 degrees. The patient had average – vertical growth pattern and proclined maxillary and mandibular incisors [Figure 3 and Table 1].The CVMI stage was stage 3, fishman hand wrist radiograph showed stage 3 approaching 4 . [Figure 3].

Figure 2: Pre - treatment- extra oral and intra oral photographs





Figure 3 :Pre-treatment: (a) Lateral cephalogram. (b) Hand wrist radiograph. (c) Orthopantamogram



The objectives of treatment in the sagittal plane were to achieve ideal overjet and overbite by mandibular advancement, skeletal and dental, in the vertical plane to maintain lower anterior facial height, overall to attain a pleasing soft tissue profile.

The initial treatment plan for the patient was to opt either for twin block or the Frankel appliance. According to our treatment objectives of growth pattern complemented with an ideal overjet, overbite, and improvement in soft-tissue profile. Thus, this led to the preference of R appliance which was fabricated with a construction bite made by sagittal advancement of 7 mm and vertical opening of 3 mm. The bite registration was done in accordance with control of the vertical growth pattern. The patient was asked to wear the appliance full time except on meals in a day. The patient was asked to follow-up every 3 weeks and was instructed to wear the appliance for a period of 6 months [Figure 4]. Following 4 months of treatment, the patient's profile and smile greatly improved due to deep bite reduction and mandibular advancement. Overjet and overbite were improved due to the postural forward positioning of the mandible. The midlines were coincident with each other and with the face. In addition,

a good buccal occlusion and Class I canine relation can be achieved after in phase II [Figure 5]. End of treatment OPG showed good root parallelism and healthy appearance of supporting tissues [Figure 6]. Superimposition and cephalometric analysis showed 4 mm of increase in mandibular length

Figure 4 :Intra oral: R appliance

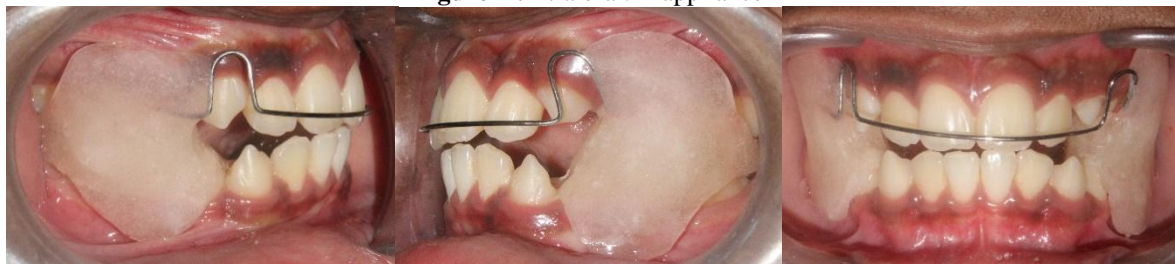


Figure 5 :Post R appliance: Extra oral and intra oral photographs





Figure 6 :Posttreatment. (a) Lateral cephalogram. (b) Orthopantomogram

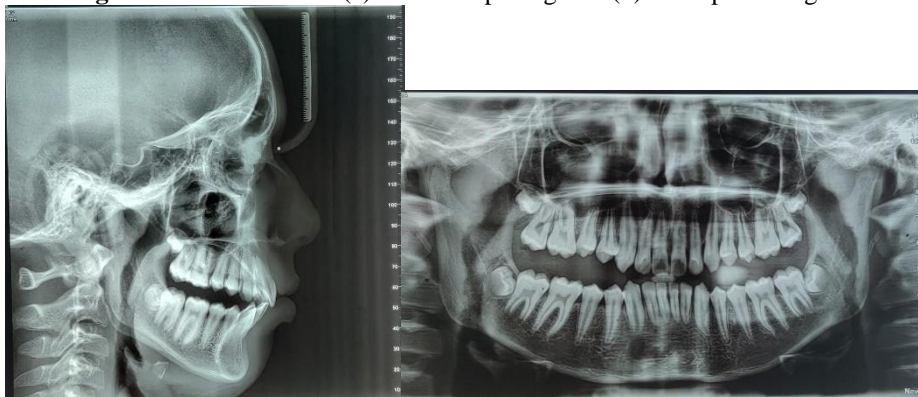


Table 1 :Cephalometric analysis

Parameters	Pre- Rx	Post- Rx
SNA (°)	81	81
Effect Max length (mm)	49	49
SNB (°)	74	77
Effect Mand length (mm)	98	101
ANB (°)	7	4
Angle of convexity (mm)	8	7
FMA (°)	35	31
SN- GO- GN (°)	32	30
LAFH (mm)	64	66
Ar- Go (mm)	39	45
Articular angle (°)	150	150
Base plane angle (°)	30	29
Upper incisor to NA (°)	27	22
Upper incisor to SN (°)	108	102
Lower incisor to NB (°)	29	39
IMPA (°)	93	99
“S” line to upper lip (mm)	2	2
“S” line to lower lip (mm)	3	5
Nasolabial angle	108	110

VI. Discussion

Class II malocclusions can result from many contributing components, both dental and skeletal. Although maxillary protrusion and mandibular retrusion are both found to be possible causative factors, it has been reported that the most common underlying cause of Class II malocclusion in a population is mandibular retrusion. [5] In this case report, R appliance has been used to bring about the correction of jaw discrepancies.

Frankel appliance stimulates normal function while eliminating lip trap, hyperactive mentalis and aberrant buccinators and orbicularis oris action. [6] The components of Frankel appliance, the buccal shields, help in obliterating the adverse effects of abnormal perioral musculature such as abnormal mentalis muscle activity which is predominantly seen in this case. Forward mandibular positioning with Frankel appliance unloads the normal environmental pressure on the condyle and hence is the mechanism to stimulate mandibular growth. [8]

According to McNamara and Petrovic, a forward positioning of 3–4 mm is sufficient to elicit the desired response from the lateral pterygoid muscle and subsequent condylar feedback. [8]

One of the limitations of twin block appliance is to elicit soft- tissue changes in and around the dentition. Hence, in this case, the twin block appliance was modified by incorporating buccal shields to the mandibular component, just as seen in a FR II appliance to bring about the desired changes in the perioral musculature. The above modification was done by taking into consideration Frankel’s philosophy of vestibular arena of operation.

In the treatment involving functional appliances, symmetrical overjet and possibility of advancing mandible without any interference are a critical issue. [9]

Usually, Twin block show a favorable mandibular response to treatment, resulting in an increase of SNB angle and reduction in ANB angle during the first 6 months of treatment,[10] whereas in our case report, SNB angle increased by 3°, ANB angle reduced by 3° while SNA angle remained the same in just 4 months . Their study also proved that twinblock appliance not only resulted in forward positioning of the mandible but also depicted mandibular lengthening as shown by the linear measurements Co- Po, +7.17 mm, whereas in our case, mandibular length also increased by 3 mm. Effective ramal length increase was also seen. It was further seen that there was an increase of about 2 mm in lower anterior facial height by clockwise rotation of the mandibular plane. Treatment of deep bite, and maintenance of growth patten from getting more vertical the bite blocks were not trimmed selectively, and achieved good results which was advantageous in our case. We were able to reduce the FMA by 4 °. Patient was satisfied with the treatment results with his self- esteem being significantly improved.

VII. Conclusion

Functional jaw orthopaedics has revolutionaried orthodontics. There have been significant improvements in the design of functional appliances, with the goal aimed at achieving greater patient acceptance and increased wear time. These appliances seem to offer a valuable treatment modality to the orthodontist. Hence, this is one such appliance which could act as an aid to orthodontist in the treatment of skeletal class II malocclusion.

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