

Skeletal Class II Malocclusion in Growing Patients: A Simplified Nonextraction Approach

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Singh DP¹, Kaur R²

¹Associate Professor, Mohali Medical Centre, Phase 2, Opposite Bassi Cinema, Mohali, Punjab, India, ahluwalia147@gmail.com

²PG Student, HS Judge Institute of Dental Sciences and Hospital, Punjab University, Chandigarh, India

ABSTRACT

In contemporary orthodontics, the complex and multifactorial etiology of class II malocclusion has always presented a clinical challenge to the orthodontists. Management of class II malocclusion requires a thorough evaluation as the treatment options available vary widely from growth modification using dentofacial orthopedics with functional appliances, dental camouflage using extraction or non-extraction approaches or even orthognathic surgery. Selection of treatment modality for class II patient is based on the age, growth potential, location of skeletal component, the severity of malocclusion and the compliance of the patient. Correction of skeletal class II malocclusion due to retrognathic mandible can be done with non-compliance appliances such as fixed functional appliances. Fixed functional appliances are emerging as viable and successful treatment option for class II patients owing to the refinement in their designs and mechanics to advance the retrognathic mandible. A wide variety of non-compliance fixed functional appliances are available that can be used with comprehensive fixed mechanotherapy. Forsus fatigue resistant device and Powerscope are two such fixed functional appliances used for class II correction. These appliances can be assembled chair-side and installed easily intraorally. This case report substantiates the efficacy of these appliances in the two types of Class II malocclusion growing patients presenting with a chief complaint of forwardly placed upper jaw and a mean age of 14 years (age range of 13–15 years).

Keywords: Class II malocclusion, Fixed functional appliance, Growth modification.

INTRODUCTION

About one-third of the population presents with class II malocclusion which is one the most common sagittal malocclusion encountered in day-to-day practice.¹ Most common single characteristic of class II malocclusion is skeletal mandibular retrusion.² Forward mandible posture can be achieved by using various functional appliances, that include both myofunctional appliances and fixed functional appliances. Numerous functional jaw orthopedic appliances used for treatment of mandibular skeletal retrusion are available. Twin Block, Frankel Functional Regulator FR-2, the Herbst appliance and bionator being the most common.² Mandibular advancement using functional appliances has been advocated for correction of skeletal retrusion in class II patients.³⁻⁵

Fixed functional appliances are being widely used as a non-extraction treatment approach in non-compliant patients presenting with mandibular skeletal retrusion. Newer appliances are available nowadays that can be assembled chair side, does not require lab work, are easy to install and are patient friendly. But at the same they are rigid enough to bring about the desired skeletal and dental correction. Refinement of fixed functional appliances offers greater freedom of functional mandibular movements thereby enhancing patient comfort.⁶

This case report illustrates the efficacy of two such appliances used in the two types of class II malocclusion in growing. The appliances studied are Forsus fatigue resistant device and Powerscope.

CONSIDERATIONS FOR FIXED FUNCTIONAL APPLIANCES⁷

1. *Age factor:* Various fixed functional appliances offer an advantage of being used in post-pubertal patients also.
2. *Growth direction:* Patients with hyperdivergent facial growth patterns are usually not considered good candidates for fixed functional appliance therapy (such patients have a large gonial angle and increased lower anterior facial height).
3. *Esthetic considerations:* Excellent results are reported in patients with skeletal class II jaw bases with retrognathic mandible treated by using fixed functional appliances. To be successful such patients should have a positive VTO (visual treatment objective). Patients with negative VTO are not good candidates for fixed functional appliances.
4. *Compliance:* Being fixed type of appliances they have an advantage that they do not demand patient compliance which is an important factor in the success of removable type of functional appliances. However, the overall orthodontic treatment can never be successful without patient's compliance; which accounts to the compliance of the patient on part of hygiene measures and appliance care.

MODE OF ACTION

The mandibular adaptation mechanism to the forward posturing induced by fixed functional appliance is similar to the one produced by removable functional appliance. The appliance is tooth borne and exerts its effects via teeth to the underlying bone by transmitting the forces developed as a result of the continuous forward posturing of the lower jaw.⁸ Despite various differences in the concept, the general mode of action is one or combination of the following:

1. Mandibular growth induction
2. Maxillary growth restriction
3. Dentoalveolar changes
4. Glenoid fossa relocation
5. Changes in neuromuscular anatomy and function.

The results obtained by using functional appliance in correction of class II malocclusion consists of successful combination of orthopedic (30–40%) and dentoalveolar (60–70%) effects.⁸

BIOMECHANICAL EFFECTS OF FIXED FUNCTIONAL APPLIANCE ON CRANIOFACIAL STRUCTURES⁹

A previous study done using finite element model of human skull investigated the displacement and stress distribution of

fixed functional appliances on craniofacial structures.¹⁰ Various biomechanical effects were seen as follows:

1. Predominant displacement was found to be dentoalveolar.
2. Mandibular incisors demonstrated forward and downward displacement. Mandible showed downward and forward rotation.
3. All dentoalveolar structures experienced tensile stresses except for ANS.
4. Condylar neck and condylar head experienced maximum tensile and von Mises stresses.

COMPLICATIONS WITH USE OF FIXED FUNCTIONAL APPLIANCES¹¹

Four types of complications most commonly seen are:

1. Breakage of bands or splints.
2. Breakage of telescoping mechanisms.
3. Loosening of bands or splints.
4. Trauma to buccal mucosa.

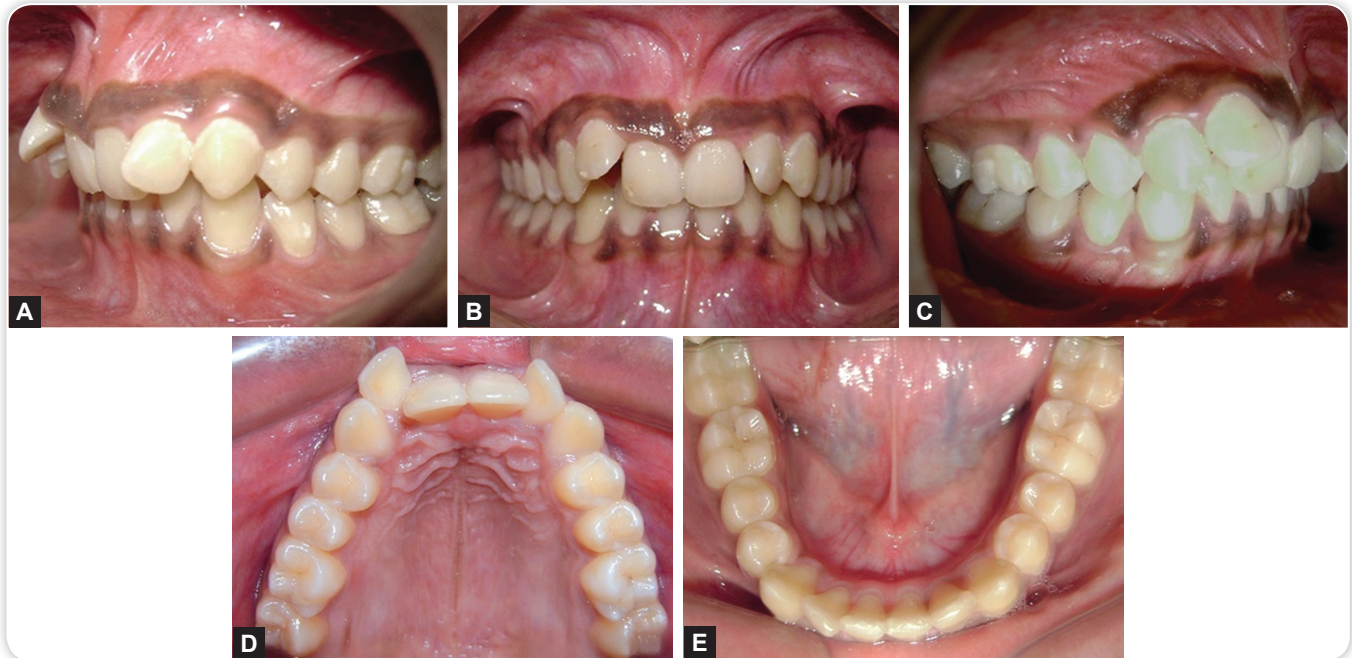
No significant differences are found in gender distribution regarding complications associated with fixed functional appliances.

Case 1

A 14-year-old male patient reported to the Department of Orthodontics with a chief complaint of forwardly placed upper jaw with backwardly placed upper front teeth. On intraoral examination he had skeletal Class II jaw relationship with Angle's Class II div 2 malocclusion. He had retroclined upper central incisors, rotated upper lateral incisors and moderately crowded lower anterior teeth with increased overbite. Soft tissue profile indicated a straight profile with competent lips and a prominent chin (Figs 1 and 2). Treatment involved correction of exhibited malocclusion using comprehensive fixed orthodontic mechanotherapy with preadjusted edgewise appliance (Roth prescription, 0.022 slot) and correction of the skeletal Class II relationship with Forsus (fatigue resistant device).

The upper and lower arches were completely bonded and leveling and alignment was carried out to get a positive overjet. The fixed functional Forsus appliance was placed once both upper and lower arches had 19 × 25 SS archwires inserted into the bracket slots. The upper and lower arch wires were cinched distal to the second molar bands and the lower arch wire had a slight buccal root torque in the anterior segment (Figs 3A to C).

The Class II correction took about six months and the total treatment time was about 18 months with the complete leveling



Figures 1A to E Intraoral photographs (Pretreatment): (A) left lateral view, (B) frontal view, (C) right lateral view, (D) maxillary occlusal view, (E) mandibular occlusal view



Figures 2A to C Extra-oral photographs (Pretreatment): (A) frontal view, (B) smiling view, (C) profile view

and aligning of the upper and lower arches and attainment of Class I molar and canine relationships (Figs 4 and 5).

Case 2

A 13-year-old male patient reported to the Department of Orthodontics with a chief complaint of irregular and

forwardly placed upper front teeth. On intraoral examination, he had skeletal Class II jaw relationship with Angle's Class II div 1 malocclusion. He had mild to moderate crowding in upper and lower front teeth with increased overbite and severely rotated right lower second premolar. Soft tissue profile indicated a convex profile with competent lips and a recessive chin (Figs 6 and 7). Treatment involved correction of



Figures 3A to C Intra-oral photographs (Forsus): (A) left lateral view, (B) frontal view, (C) right lateral view



Figures 4A to E Intra-oral photographs (Post-treatment): (A) left lateral view, (B) frontal view, (C) right lateral view, (D) maxillary occlusal view, (E) mandibular occlusal view

exhibited malocclusion using comprehensive fixed orthodontic mechanotherapy with preadjusted edgewise appliance (Roth prescription, 0.022 slot) and correction of the skeletal Class II relationship with Powerscope.

The upper and lower arches were completely bonded and leveling and alignment was carried out to get a positive overjet. The fixed functional Powerscope appliance was placed once both upper and lower arches had 19×25 SS archwires inserted into the bracket slots. The upper and lower arch wires were cinched distal to the second molar bands and the lower arch wire had a slight buccal root torque in the anterior segment (Fig. 8).

The Class II correction took about six months and the total treatment time was about 18 months with the complete leveling

and aligning of the upper and lower arches and attainment of Class I molar and canine relationships (Figs 9 and 10).

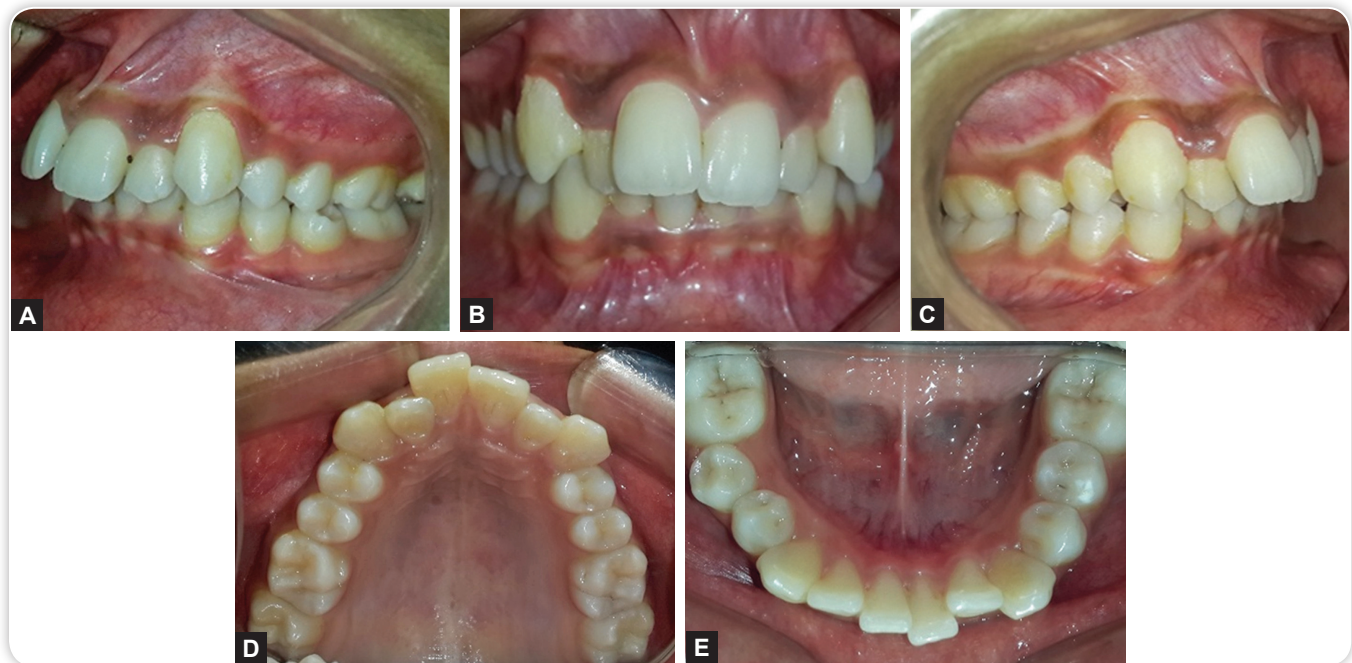
DISCUSSION

Over the years many fixed functional appliances have been used by orthodontists and only a few have shown well acceptance and favourable results on the patient.^{12,13} Forsus appliance which has been recently introduced, is well accepted showing stable results.¹⁴ These appliances are also operator friendly as these are easy to insert and remove intraorally.

This case report presents the efficacy of these appliances in the two types of Class II malocclusion growing patients with a mean age of 14 years (age range of 13–15 years). These



Figures 5A to C Extra-oral photographs (Post-treatment): (A) frontal view, (B) smiling view, (C) profile view



Figures 6A to E: Intra-oral photographs (Pretreatment): (A) left lateral view, (B) frontal view, (C) right lateral view, (D) maxillary occlusal view, (E) mandibular occlusal view

appliances influence the jaws via the following mechanisms: remodeling of the mandibular condyle, remodeling of the glenoid fossa, repositioning of the mandibular condyle in the glenoid fossa and autorotation of the mandibular bone.¹⁵ The post-treatment measurements showed favorable changes with the SNB angle showing a positive increase in both the

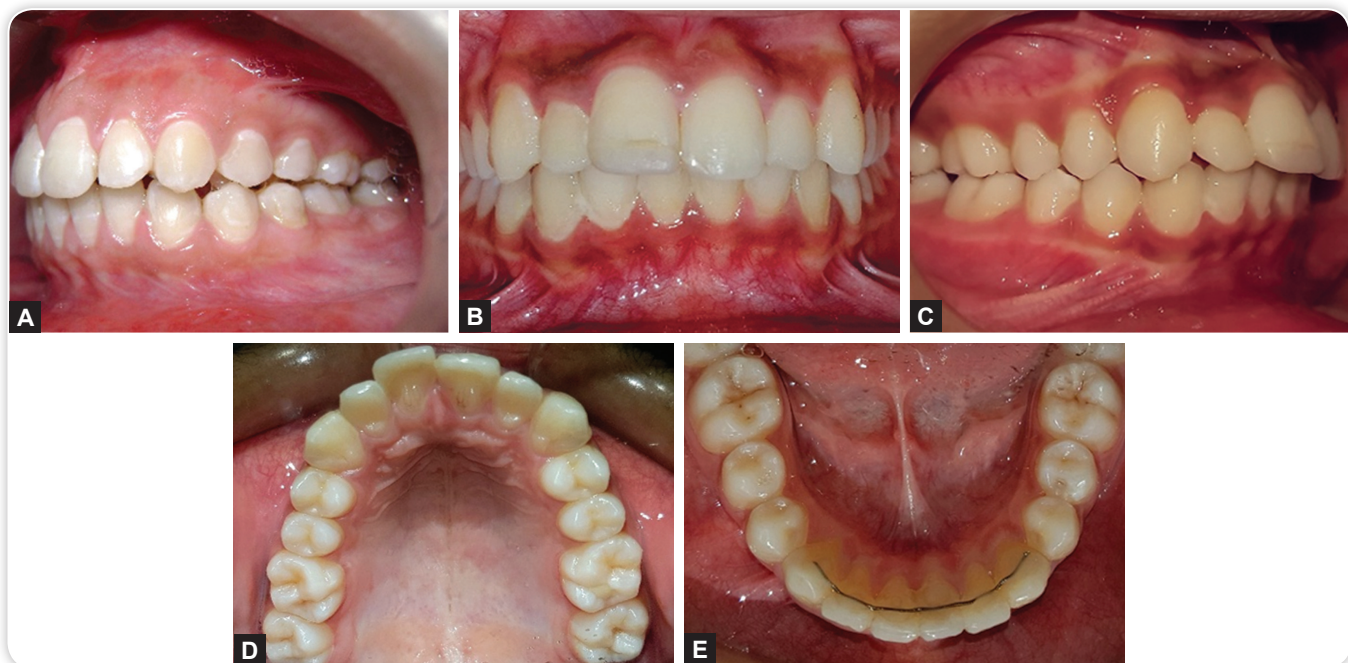
cases. A slight headgear effect on the upper jaw, as is evident by the post treatment reduction in the linear measurement of U1 to N-A in both the cases and some bite opening, as was evident from the increase in the S-N to GoGn angle, was also observed. However, inspite of pretorqued lower archwire, slight dentoalveolar movement in the lower teeth was also



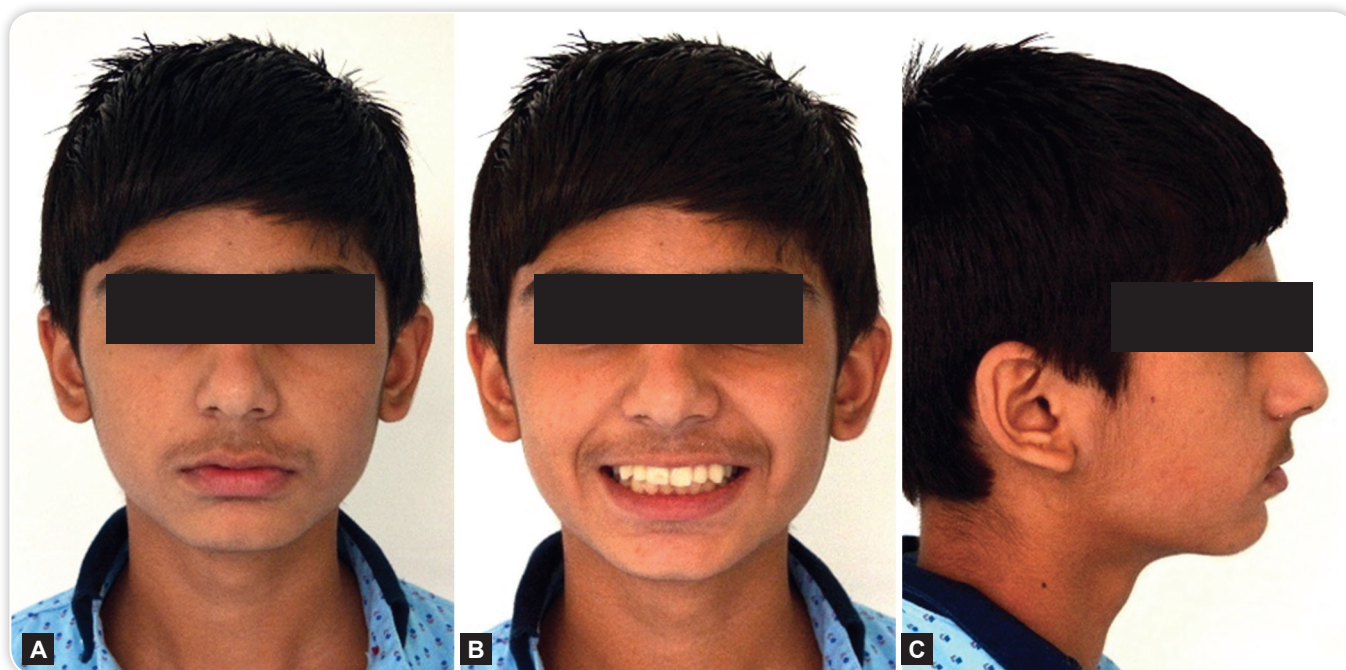
Figures 7A to C Extra-oral photographs (Pre-treatment): (A) frontal view, (B) smiling view, (C) profile view



Figures 8A to C Intra-oral photographs (Powerscope): (A) left lateral view, (B) frontal view, (C) right lateral view



Figures 9A to E Intra-oral photographs (Post-treatment): (A) left lateral view, (B) frontal view, (C) right lateral view, (D) maxillary occlusal view, (E) mandibular occlusal view



Figures 10A to C Extra-oral photographs (Post-treatment): (A) frontal view, (B) smiling view, (C) profile view

seen leading to the proclination and protrusion of the lower anterior teeth which was also appreciated in the soft tissue analysis of the lower lip. This dentoalveolar correction of class II malocclusion slightly masks the overall skeletal correction that is achieved by the fixed functional appliances. This is a common side effect of these appliances as compared to the conventional removable functional appliances which produce almost a pure total skeletal effect in their use.

The treatment time for correction in both the cases was almost the same i.e. six months which is quite acceptable with the patients which are quite apprehensive about the difficulty in mastication as well as limitation of jaw movement on installation of the fixed functional appliances.

CONCLUSION

- The noncompliance fixed functional method has been a realistic compromise for patients who are unwilling to wear removable functional appliances and a boon in patients requiring alignment of teeth prior to functional therapy.
- The two intraoral functional appliances used in this case report namely Forsus and Powerscope are effective means of correction of skeletal class II malocclusion with limited drawbacks of dentoalveolar movement of lower teeth leading to minor proclination and protrusion of lower front teeth.
- The two intraoral functional appliances used in this case report has an additional distalizing skeletal effect on the

upper arch which reduces the need to add auxiliary forces from extraoral appliances such as headgears when they are indicated.

- However, still future research is needed to comparatively assess their skeletal efficiency in treating class II malocclusions as well as studies to compare them with other conventional as well as fixed functional appliances.

Address for Correspondence

Devinder Preet Singh
Associate Professor
Harvansh Singh
Judge Institute of Dental Sciences and
Hospital Panjab University
Chandigarh, India
mob: +919316557350
e-mail: ahlwalia147@gmail.com.

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