Journal of Dentomaxillofacial Radiology, Pathology and Surgery

Winter 2023. Volume 12. Number 1

CasePaper: Introduction of a New Functional Appliance Called Guilan Functional Appliance (GFA)

Davood Atrkaar Rowshan[1], Forough Moghassem Hamidi[2*], Fateme Masoumi[1], Hossein Gholizade[3]

[1] Assistant Professor, Department of Orthodontics, School of Dentistry, Guilan University of Medical Sciences, Rasht, Iran
[2] Postgradute Student of Orthodontics, Department of Orthodontics, School of Dentistry, Guilan University of Medical Sciences, Rasht, Iran
[3] Gradute Student, Dental School, Shahid Beheshti University of Medical Sciences, Tehran, Iran

Use your device to scan and read the article online

Citation Atrkaar Rowshan D, Moghassem Hamidi F, Masoumi F, Gholizade H. Introduction of a New Functional Appliance Called Guilan Functional Appliance (GFA). Journal of Dentomaxillofacial Radiology, Pathology and Surgery. 2023; 12(1):24-35.

http://dx.doi.org/10.32592/3dj.12.1.24

ABSTRACT

Most authors considered functional appliances to be primarily orthopedic tools to influence the facial skeleton of the growing child in the condylar and sutural area to achieve skeletal improvement. However, these appliances exert orthodontic effects in the dentoalveolar region; they have been used mainly for the treatment of skeletal class II patients.

In this article, we intend to introduce a new functional appliance called Guilan Functional Appliance (GFA), which is effective in the treatment of class II patients, even in adult cases and its construction seems to be much easier than conventional functional appliances.

Article info:
Received: 10 Dec 2022
Accepted: 30 May 2023
Available Online: 27 Jun 2023

Keywords:
Class II Malocclusion
Treatment
Functional Appliance
Growth Modification

**** Corresponding Authors:***
Forough Moghassem Hamidi.
Address: *Postgradute Student of Orthodontics, Department of Orthodontics, School of Dentistry, Guilan University of Medical Sciences, Rasht, Iran*
Tel: *+989112440180*
E-mail: *Foroughhamidi17@gmail.com*

1. Introduction

Functional appliance describes a group of orthodontic appliances, employed in the treatment of skeletal discrepancy. Roux first reported the influences of natural forces and functional stimulation on form in 1883 as a result of studies performed on the tail and fins of dolphins. Roux described the characteristics of functional stimuli as they build, mold, remold, and preserve the tissues. His working hypothesis became the biomechanical background of both general and functional jaw orthopedics. The clinical aspects of the Roux hypothesis had already been applied by Robin, treating children with his “monobloc” as indicated in cases with glossoptosis and Andersen and Häupl (1938) (1). According to Häupl, functional jaw orthopedics can only be performed with appliances with "passive" appliances that transmit only the muscular stimulus. Because of their abilities to transfer muscular forces from one area to the other, functional orthopedic appliances were considered transformations (1).

The forces employed in orthodontic and orthopedic procedures include tensile and shearing forces. Tensile forces cause stress and strain in functional therapy. They also alter the stomatognathic muscle balance. Both external (primary) and internal (secondary) forces can be observed in each force application. External forces include both occlusal and muscular forces acting on the dentition (1).

In the regulation of craniofacial and occlusal development, environmental influences are also important. External influences act as modifiers of the genetic program. Humans possess a genetic makeup that allows the development of normal occlusion, given the right environmental circumstances. Therapeutic actions can influence external components of development: bone and surrounding structures react to external influences (1).

Functional jaw orthopedics is a treatment of skeletal dysplasia by repositioning the mandible. The mechanism of treatment is the activated muscle force. The mode of action is dependent on the construction bite (1).

Skeletal class II malocclusion, one of the most prevalent orthodontic conditions worldwide, (2) is mainly a consequence of mandibular retrusion. (3) Therefore, removable or fixed functional appliances were designed to increase mandibular growth by forward positioning of the mandible. (3) Functional appliances can be classified into two groups: tooth-borne and tissue borne, (4) and either are made of a one-piece (Mono Block) or a two-piece (Twin Block).

In general, tissue–borne appliances, such as Frankel produce less dental compensation than tooth-borne ones such as Activators, Bionators and Twin Blocks (5). Unlike the activator, which can be modified in many ways and still produce an acceptable result, the Frankel appliance demands a rigid discipline of design, fit, and use, as well as proper treatment timing and case selection (5). Patient daytime wear is a motivational challenge for the orthodontist and has been an Achilles’ heel in that many clinicians have not been able to replicate Frankel’s spectacular results (5). Twin block appliance was developed by Clark (6) and is the most commonly used functional appliance (7). There are some disadvantages with twin block: Proclination of the lower incisors during the treatment with twin block reduces the potential of achieving maximum skeletal effects (8). Wire clasps can cause tissue irritation and require repeated adjustment. Wire elements on the labial surface of the teeth may also jeopardize esthetics (9).

2. Discussion

Despite the positive therapeutic aspects of using conventional functional appliances, some disadvantages can affect the patient's cooperation, the duration of use, and, consequently, the results obtained. One of the disadvantages of using functional appliances, such as Bionator or Frankle, is that they are bulky, which affects the duration of use by the patient and can disrupt the patient's cooperation, thus hampering treatment results and quality of work.

One more problem with these functional appliances is the inability to use them simultaneously with fixed appliances. In this way, the available treatment should reach the desired result and the retention period should be passed until the functional appliances is discontinued and fixed treatment is started. This will prolong the orthodontic treatment time in case of poor patient cooperation. In other words, if we can design the functional appliances in a way that can be used simultaneously with the fixed appliance, this will cause the functional and fixed therapy to progress together, improve patient cooperation and reduce treatment time. The other problem with functional therapy is that orthopedic treatment may experience a relapse at the beginning or middle of fixed orthodontic therapy following the end of functional therapy. In this case, we have to go back and reuse the functional appliances.

Another disadvantage of a conventional functional appliance is the complex laboratory steps, such as wire components in twin blocks and acrylic components in Frankle, which require a skilled technician and major laboratory works and increase the cost of treatment for the patient. Also, the time between taking the impression of the patient, sending the mold to the laboratory, and

delivering the plate to the office will prolong treatment time.

In this article, we intend to introduce a new functional appliance to modify the retruded mandible, which is tissue-borne and can be modified to be solely tooth-borne, and has been used in the treatment of several growing patients and even adults successfully.

This appliance is named Guilan Functional Appliance (GFA), and we will discuss its features and construction method in the following.

This appliance's most important positive feature is its ability to be used simultaneously during fixed orthodontic treatment, it can be easily modified to be usable for the patient during fixed treatment. Routinely, fixed treatments of patients start after the end of the orthopedic phase, with the cessation of the use of the available appliances. Therefore, the skeletal results created during this phase might not be maintained. To avoid interference with the brackets on the patient's tooth surfaces and the tooth movements created during the alignment phase, the GFA can be easily shaved from the labial and occlusal surfaces and therefore can be easily used to maintain the patient's corrected sagittal jaw relationship during the fixed treatment phase.

GFA appliance is less bulky than conventional functional appliances, which may positively affect patient cooperation.

On the other hand, the simplicity of its construction and the lack of special equipment, which will be discussed below, can be one of the advantages of this functional appliance. No need for any wire components makes this appliance very simple to make by the office nurse very quickly. As a result, the time needed to send the patient's impression to the laboratory and the time for the appliance delivery to the office, which is time-consuming, is avoided.

In addition to growing patients, in selected adult patients who are not keen to have surgery for their skeletal problems, this appliance has been used and very positive results have been obtained.

The clinical procedure, almost like all other functional appliances, is as follows:

1. Take two sets of impressions of the upper and lower arch and pour the dental stone cast.

2. Take the construction bite as usual.

3. Mount one set of casts based on construction bite in the articulation (Figure 1-A).

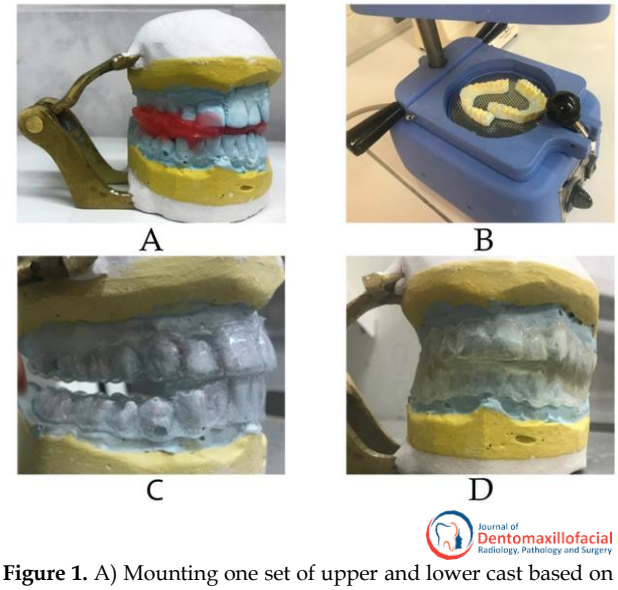


Figure 1. A) Mounting one set of upper and lower cast based on construction bite. B) Upper and lower vaccum-formed plate is made on the stone model. C) Trimming and transferring upper and lower plates to the articulator. D) Filling the interocclusal space by acrylic resin

4. Block out other sets of the upper and lower cast around the gingival margin.

5. Fabricate upper and lower vacuum-formed plates on the block outcast with thermoformable sheets using standard vacuum-forming procedures. Both plates should be extended to the most posterior tooth of the arch (figure 1-B).

6. Trim and transfer upper and lower plates to the mold in the articulator (figure1-C).

7. Fill the interocclusal space with acrylic resin and leave the airway in the anterior area (figure1-D).

In the following, some patients treated with GFA are shown. Before and after photography are presented (Figures 2 to 6). Note that the last 2 cases were post puberty when the treatment was initiated. Photos were attached after obtaining informed consent from the patients.

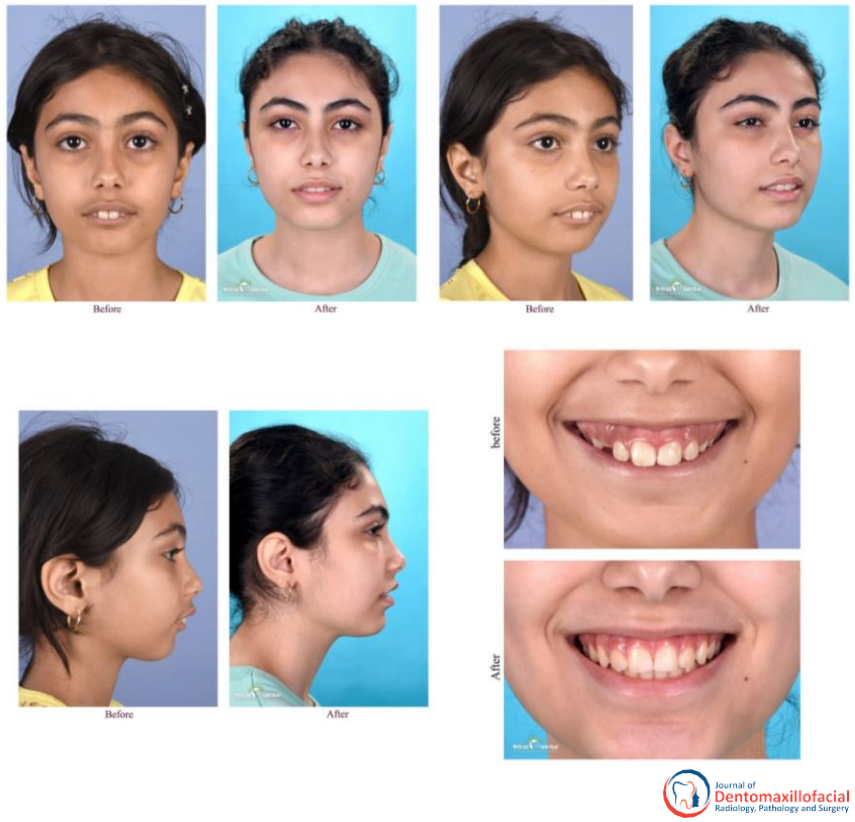


Figure 2-1(Case I): Before and after treatmrnt extra oral photography in an 11 years old girl

Figure 2-2(Case I): Before and after treatment intra oral photography in an 11 years old girl

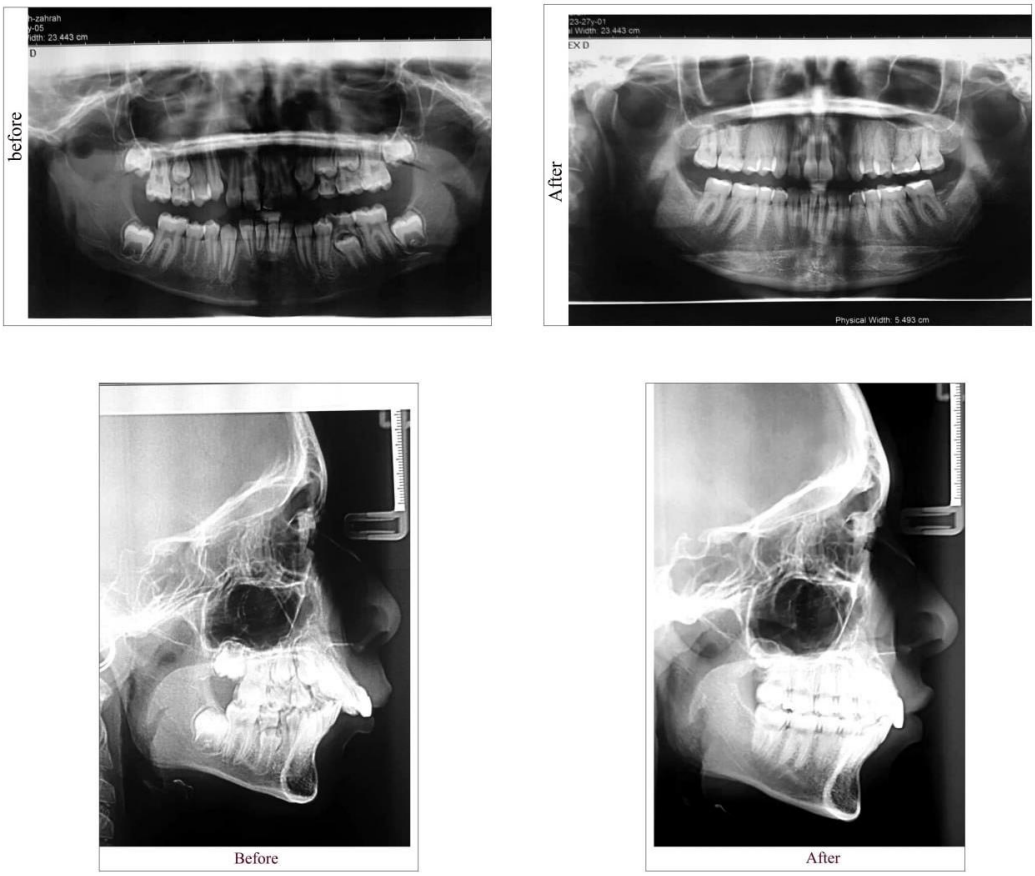


Figure 2-3 (Case I): Before and after treatment radiography in an 11 years old girl

Figure 3-1 (Case II): Before and after treatment extra oral photography in a 12 years old boy

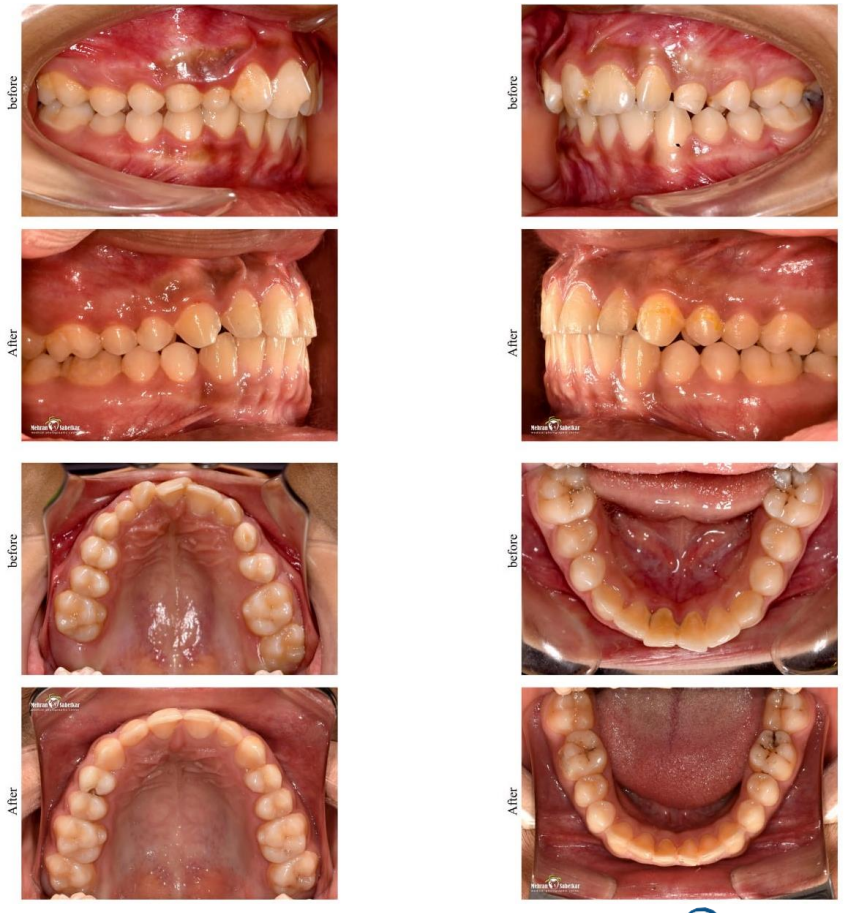
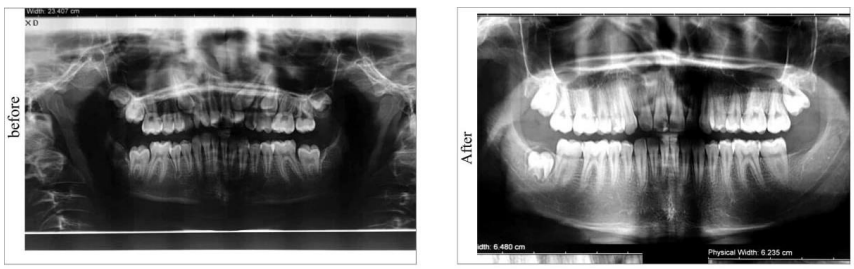


Figure 3-2 (Case II): Before and after treatment intra oral photography in a 12 years old boy




Before


After

Figure 3-3 (Case II): Before and after treatment radiography in a 12 years old boy

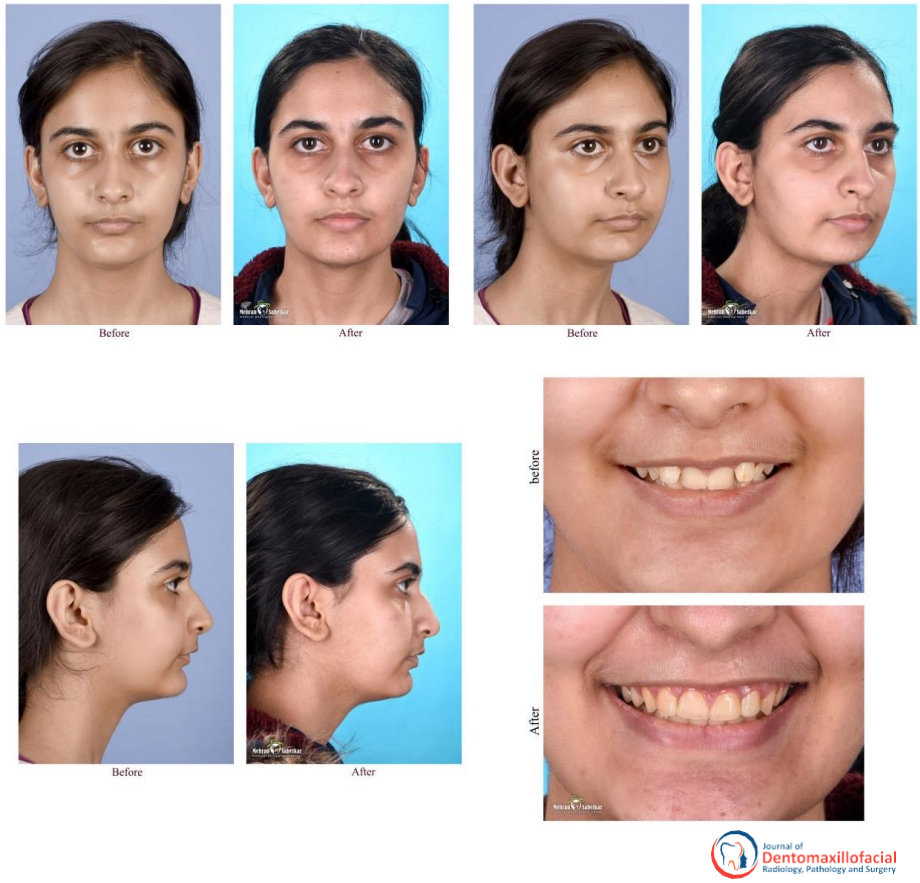


Figure 4-1 (Case III): Before and after treatment extra oral photography in a 13 years old girl

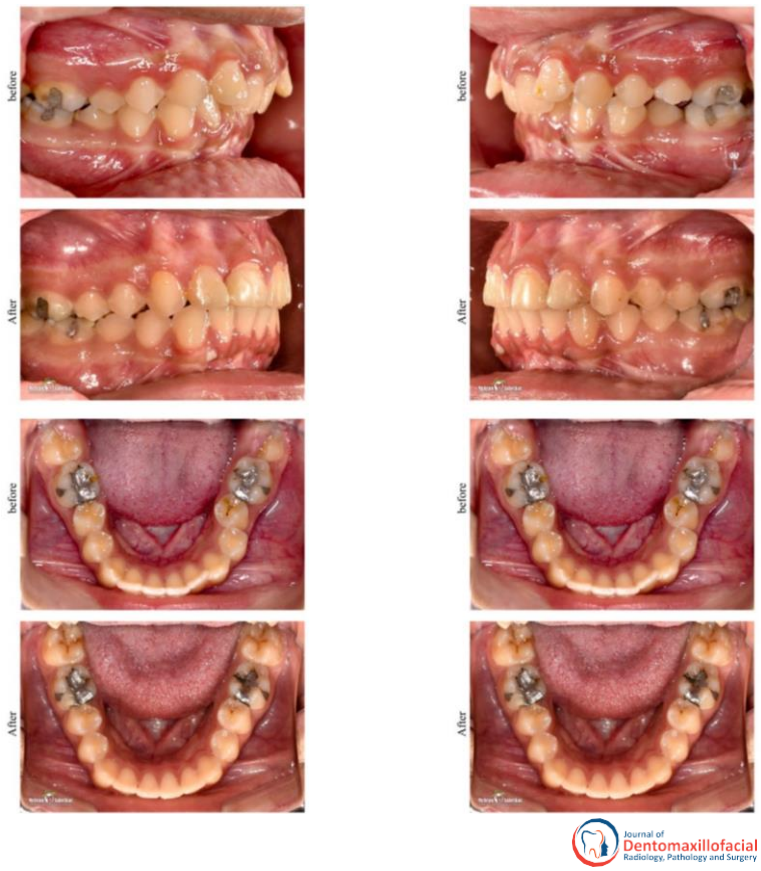


Figure 4-2 (Case III): Before and after treatment intra oral photography in a 13 years old girl

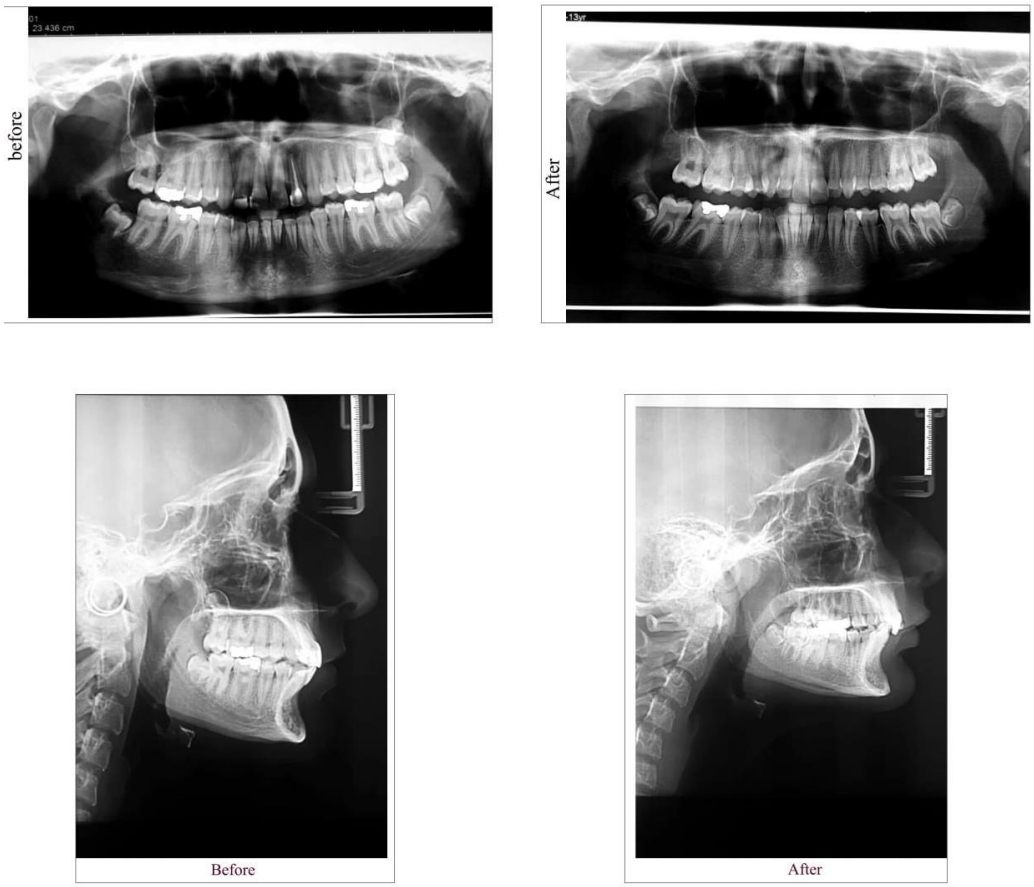


Figure 4-3 (Case III): Before and after treatment radiography in a 13 years old girl

Figure 5-1 (Case IV): Before and after treatment extra oral photography in a 24 years old girl

Figure 5-2 (Case IV): Before and after treatment intra oral photography in a 24 years old girl

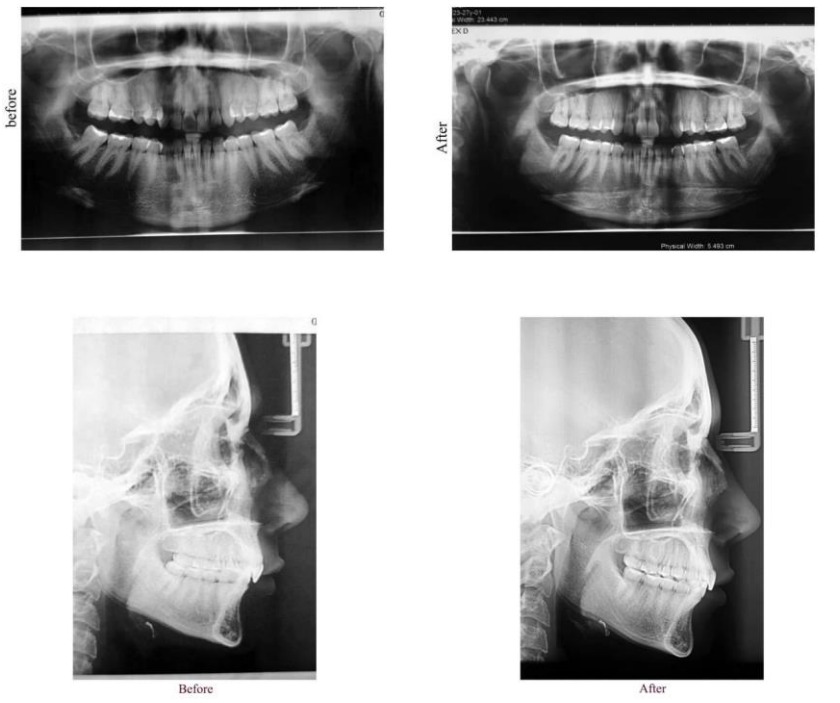


Figure 5-3 (Case IV): Before and after treatment radiography in a 24 years old girl

Figure 6-1 (Case V): Before and after treatment extra oral photography in a 20 years old girl

Figure 6-2 (Case V): Before and after treatment intra oral photography in a 20 years old girl

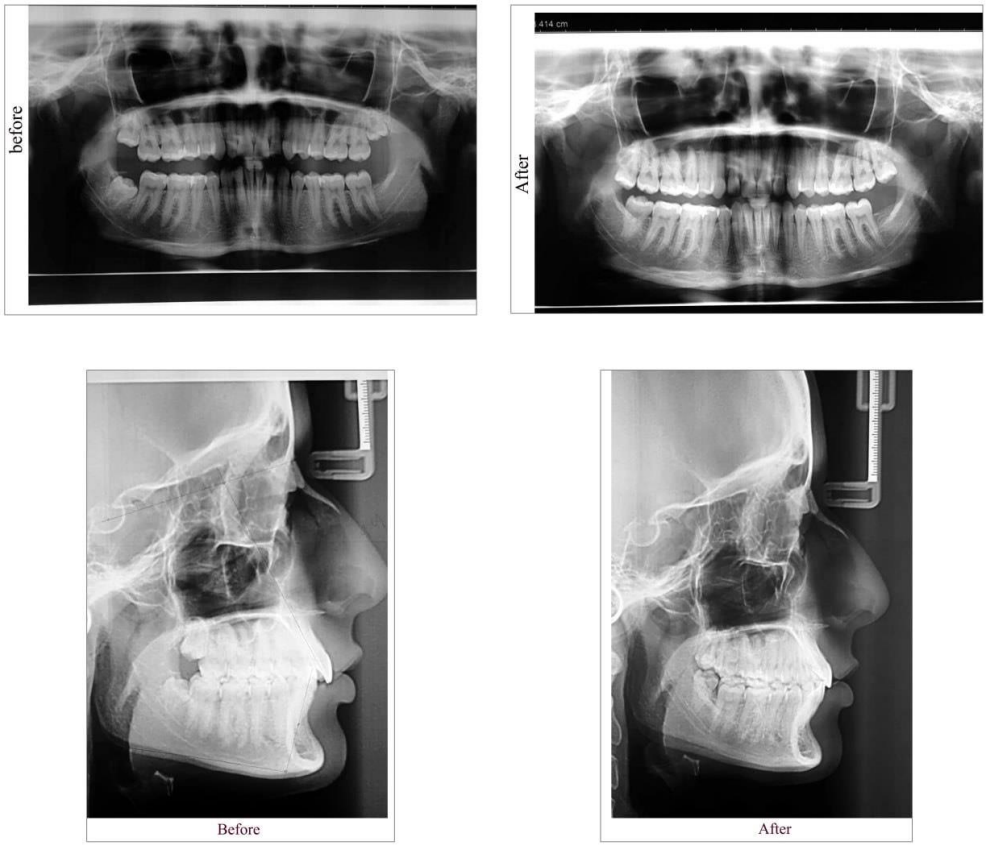


Figure 6-3 (Case V): Before and after treatment radiography in a 20 years old girl

4. Conclusion

It should be emphasized that the results obtained from our patients need to be evaluated carefully and it is recommended that the therapeutic effects of GFA with some other functional devices in different developmental periods be studied in the future.

Ethical Considerations

Compliance with ethical guidelines

Not Applicable.

Funding

None.

Authors'contributions

Davood Atrkar Rowshan: Conceptualization, Methodology, Writing - Review & Editing Forough Moghassem Hamidi: Resources, Investigation, Visualization Fatemeh Masoomi: Data curation, Writing - Original Draft Hossein Gholizade: Project administration, Supervision, Funding acquisition

Conflict of Interests

The authors declare no conflict of interest

Availability of data and material

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Acknowledgments

None.

References

1. Rakosi.T, Graber.t.Orthodontic and dentofacial oethopedic treatment. Stuttgart • New York. 2010: 68. [Link]
2. Austro MD, González E, Peñalver MA, et al, Short-term dentoskeletal changes following Class II treatment using a fixed functional appliance: the Austro Repositioner. Journal of Orofacial Orthopedics/ Fortschritte der Kieferorthopädie. 2018; 79(3):147- 56. [DOI: 10.1007/s00056-018-0135-3]
3. Perinetti G, Primožič J, Furlani G, et al. Treatment effects of fixed

functional appliances alone or in combination with multibracket appliances: a systematic review and meta-analysis. Angle Orthod. 2015; 85(3):480-92. [DOI: 10.2319/102813-790.1]

4. Pakshir H, Mokhtar A, Darnahal A, et al. Effect of bionator and farmand appliance on the treat ment of mandibular deficiency in prepubertal stage. Turk J Orthod. 2017; 30(1):15. [DOI: 10.5152/TurkJOrthod.2017.1604] [PMID] [PMCID]
5. Lee W. Graber , Robert L. Vanarsdall , Katherine W. L. Vig. Current Principles and Techniques 6th Edition, Kindle Edition: 2017:1092
6. Clark WJ. The Twin Block technique. A functional orthopedic appliance system. Am J Orthod Dentofac Orthop. 1988;93:1-18. [DOI: 10.1016/0889-5406(88)90188-6]
7. Chadwick SM, Banks P, Wright JL. The use of myofunctional appliances in the UK: a survey of British orthodontists. Dent Update. 1988;25:302-8. [PMID]
8. Patini R, Gallenzi P, Meuli S et al. Clear aligners' effects on aesthetics: evaluation of facial wrinkles. J Clin Exp Dent.2018;10:696-701. [DOI: 10.4317/jced.54925] [PMID] [PMCID]
9. Behroozian A, Kalman L. Clear Twin Block: A Step Forward in Functional Appliances. Dental Hypotheses. 2020; 11(3):91. [DOI:10.4103/denthyp.denthyp_14_20]