Perceived facial changes of Class II Division 1 patients with convex profiles after functional orthopedic treatment followed by fixed orthodontic appliances

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Introduction: The aim of this research was to investigate the perceived facial changes in Class II Division 1 patients with convex profiles after functional orthopedic treatment followed by fixed orthodontic appliances. **Methods:** Pretreatment and posttreatment profile photographs of 12 Class II Division 1 patients treated with activators, 12 Class II Division 1 patients treated with Twin-block appliances, and 12 controls with normal profiles treated without functional appliances were presented in pairs to 10 orthodontists, 10 patients, 10 parents, and 10 laypersons. The raters assessed changes in facial appearance on a visual analog scale. Two-way multivariate analysis of variance was used to evaluate differences among group ratings. **Results:** Intrarater reliability was strong in most cases (intraclass correlation coefficients, >0.7). The internal consistency of the assessments was high (alpha, >0.87), both within and between groups. The raters consistently perceived more positive changes in the Class II Division 1 groups compared with the control group. However, this difference hardly exceeded 1/10th of the total visual analog scale length in its highest value and was mostly evident in the lower face and chin. No significant differences were found between the activator and the Twin-block groups. **Conclusions:** Although the raters perceived improvements of the facial profiles after functional orthopedic treatment followed by fixed orthodontic appliances, these were quite limited. Thus, orthodontists should be tentative when predicting significant improvement of a patient's profile with this treatment option. (Am J Orthod Dentofacial Orthop 2017;152:80-91)

Class II malocclusions have high prevalences in the population and are evident in a significant percentage of patients seeking orthodontic treatment.[1] A common treatment option, especially for growing skeletal Class II patients with a convex profile due to a retrognathic mandible, involves functional orthopedic treatment aiming to enhance mandibular growth.[2] Activator and Twin-block are 2 popular functional appliances of this type.[2,3]

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Previous studies that evaluated the soft tissue response to activator and Twin-block treatment using cephalometric measurements reported improvement of facial profiles after functional treatment.[4-7] A recent systematic review on this topic concluded that skeletal effects are minimal when natural growth is taken into account, but there are significant dentoalveolar and soft tissue changes.[2] However, the clinical impact of these changes is still questionable, even regarding soft tissues.

Improving facial appearance is an important goal of contemporary orthodontic treatment and a main reason for seeking treatment. Thus, patient satisfaction is closely related to improvement of the facial esthetic parameters.[8] Patients with a Class II skeletal pattern usually have increased facial convexity and retruded positions of the mandibular hard and soft tissues. These patients seek orthodontic treatment mainly to improve their facial appearance and consequently their self-esteem and quality of life.[9]

The definitions of beauty and attractiveness are complex and highly subjective. Probably, what laypersons

find attractive might not necessarily agree with patients' or experts' opinions, influenced by their personal experiences and educational backgrounds, respectively. However, the orthodontic treatment outcome should meet patients' and parents' expectations, and it must also be perceivable during social interactions.[10]

To our knowledge, no authors have attempted to investigate the esthetic outcome of functional orthopedic treatment combined with fixed orthodontic appliances in patients with convex facial profiles as perceived by different groups of raters who assessed actual facial images. Thus, this was the main purpose of our study. Secondary objectives were to assess potential differences between groups of raters, functional appliances (activator and Twin-block), and regions of the face.

MATERIAL AND METHODS

The study protocol was approved by the ethical committee of the dental school of Aristotle University of Thessaloniki in Greece (protocol 07/05-11-2015). All parents or guardians provided signed informed consent that allowed for the use of the patients' data for research purposes.

The sample was retrieved from the postgraduate clinic of the Department of Orthodontics of Aristotle University. Through retrospective searches of patient files, the most recent patients who fulfilled the inclusion criteria were assigned to groups. Selection was designed to create 3 groups of 12 persons, each consisting of 6 males and 6 females. Two would be the test groups and one the control group.

For the test groups, the dates of treatment completion ranged from January 2000 to October 2015. The initial diagnostic records were considered in the sample selection process. The final diagnostic records were examined at this stage only to confirm availability.

The inclusion criteria for the test groups were (1) full initial and final diagnostic records (medical, dental, and orthodontic histories, panoramic and lateral cephalometric radiographs, dental casts, intraoral and extraoral photographs of good quality and without obvious positional or other errors), (2) Class II Division 1 malocclusion at the beginning of orthodontic treatment (Class II, more than half cusp in molars bilaterally), (3) convex profile defined by facial contour angles greater than 15° for males and greater than 17° for females[11] at the initial lateral cephalometric radiograph, (4) mixed dentition at the beginning of orthodontic treatment, (5) complete treatment with functional (activator or Twin-block) and fixed orthodontic appliances, (6) nonextraction treatment (excluding third molars), (7) white origin, and (8) no craniofacial anomalies, syndromes, clefts, congenitally missing teeth (excluding third molars), severe facial asymmetries, or functional mandibular shift greater than 1 mm.

In the test groups, Class II or other types of interarch elastic forces were used during the fixed appliance stage when deemed necessary by the treating doctor.

The control group comprised 12 patients with normal facial contours before and after orthodontic treatment. Nine of them had Class I and 3 had Class II malocclusions with less than a half-cusp distal molar relationship bilaterally. In this group, the facial contour angle was between 7° and 15° for males and between 9° and 17° for females, both at the initial and final lateral cephalometric radiographs. The other inclusion criteria were identical to those of the test groups. Orthodontic treatment in these patients was completed between October 2005 and October 2015 and included fixed and sometimes, additionally, removable orthodontic appliances, but no functional appliances. Interarch elastic forces were used in the control sample at the later stages of treatment when deemed necessary to achieve proper interdigitation. After sample selection, the occlusal treatment outcomes of all groups were investigated using final casts and intraoral photographs.

The initial and final profile photographs of the 36 patients (Table I) were assessed. All photographs were taken with the Frankfort horizontal plane parallel to the ground, the teeth in maximum intercuspation, and the lips at rest. Photographs that were not in digital form (35-mm slides) were converted into digital files of 300 dpi resolution using an appropriate scanner (J232D Perfection V330; Epson, Jakarta, Indonesia). Then all the photographs were edited in Adobe Photoshop CS5 (Adobe Systems, San Jose, Calif) to have a consistent white background and similar brightness and contrast.

The adjusted photographs were evaluated by 4 groups of raters (orthodontists, patients, parents, and laypersons). The patients' group of raters was randomly selected from the Class II Division 1 patients who were treated in our clinic during the study and were between 10 and 15 years of age. The parents' group comprised parents of equivalent patients. Apart from patients, the other groups were composed of adults of various ages (20-66 years old). Each rater group consisted of the first 30 white persons who agreed to participate; they formed groups of equal numbers of males and females. Care was taken to ensure that all groups of raters, except orthodontists, had wide ranges of educational levels and socioeconomic statuses. No rater was related to those in the study sample, and the orthodontists were not involved at any stage of treatment.

The initial and final facial profile photographs of each patient were presented in pairs, in a printed A4-size