



Fixed-functional appliance treatment combined with growth hormone therapy

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The purpose of this study was to illustrate the effects of growth hormone (GH) therapy and fixed functional appliance treatment in a 13-year-old Class II malocclusion patient without GH deficiency. GH has been shown to effectively increase endochondral growth and induce a more prognathic skeletal pattern. Although a major concern in Class II retrognathic patients is chin deficiency, long-term studies have shown that the mandibular growth enhancement effects of functional appliances are clinically insignificant. This case report demonstrates that the mandible grew significantly during fixed functional appliance treatment combined with GH therapy, with stable results during 2 years 11 months of retention. More studies are needed to evaluate GH therapy as a supplement in Class II treatment. (*Am J Orthod Dentofacial Orthop* 2017;152:402-12)

When a Class II patient has mandibular growth deficiency, we usually hope to increase mandibular growth to improve the patient's facial esthetics. However, randomized clinical trials^{1,2} and systematic reviews^{3,4} have shown that it is not possible to effectively increase skeletal growth in children. Some researchers still argue that the effectiveness of mandibular growth treatment depends on the treatment timing,⁵ but until now, there have been no long-term studies to support this hypothesis.^{6,7} Thus far, dentoalveolar changes and short-term increases in mandibular growth are the only proven effects of functional appliance treatment.

Human growth hormone (GH) is a polypeptide chain with 188 amino acids that is produced by the anterior pituitary gland. GH deficiency can delay craniofacial growth and tooth eruption.⁸ Growth deficiency of the mandible is usually more severe than growth deficiency of the maxilla.^{9,10} GH has been shown to be effective for increasing craniofacial growth in GH-deficient patients, particularly in growth sites with endochondral ossification, such as condylar cartilage.^{11,12} In these patients, GH induced a more prognathic growth pattern.^{8,13}

Children with short stature without GH deficiency have also been treated with biosynthetic GH. However, there has been much controversy regarding the effects of systemic GH administration in patients with familial short stature who are not deficient in GH.^{14,15} Because of the competitive nature of Korean society, GH therapy is frequently recommended by many growth clinics, even to adolescents who are not particularly small or not deficient in GH. There have been attempts to treat malocclusion patients orthodontically while they were simultaneously receiving GH therapy.¹⁶⁻¹⁹ Case reports of patients with Turner syndrome,^{16,18} pituitary dwarfism,¹⁹ and short stature with a normal GH level¹⁷ have been published, and all have indicated that mandibular growth increased when orthodontic treatment was combined with GH treatment.

Because it has become more difficult to obtain good compliance during orthodontic treatment, compliance-free fixed functional appliances are gaining popularity.²⁰ Because GH therapy usually increases mandibular growth in GH-deficient patients, and increasing mandibular growth is the major concern of the orthodontist during the treatment of Class II patients with mandibular deficiency, functional appliance treatment combined with GH therapy would be worth assessing. See [Supplemental Materials](#) for a short video presentation about this study.

DIAGNOSIS AND ETIOLOGY

A boy, aged 13 years 7 months, came with chief complaints of proclined maxillary incisors and a retruded chin (Fig 1). He had undergone tonsillectomy when he

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All authors have completed and submitted the ICMJE Form for Disclosure of Potential Conflicts of Interest, and none were reported.

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Fig 1. Pretreatment intraoral and facial photographs.



Fig 2. Pretreatment study casts.

was 7 years old but still suffered from chronic allergic rhinitis and mouth breathing.

Intraoral photographs (Fig 1), study casts (Fig 2), and panoramic radiographs (Fig 3) showed mild dental

spacing, large overbite and overjet, flared maxillary incisors, and a lingual crossbite on the right first premolar. Overbite was 4.0 mm, overjet was 5.5 mm, and there was a mild Class II molar relationship on both sides. All

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