Abstract: Orthodontic treatment for skeletal Class II malocclusion was undertaken with the aim of achieving orthopedic correction by modifying the growth pattern. A case of Class II, Division 1 malocclusion in the late mixed dentition was corrected to a Class I molar relationship by primarily using cervical-pull headgear. Cephalometric analysis indicated a reduction in the maxillo-mandibular discrepancy (ANB°) due to the correction of a skeletal Class II malocclusion to a Class I occlusion. The superimposition demonstrated that this was achieved by favorable growth of the mandible, control of maxillary first molars in an antero-posterior direction and retraction of maxillary incisors. Proclination of mandibular incisors was reduced. Significant improvement in the soft-tissue profile was noted.

Key words: Class II malocclusion; cervical-pull headgear; orthopedic correction.

Introduction:
The treatment of Class II malocclusions in growing patients can be accomplished by several different methods. One method involves the use of extraoral anchorage via a headgear for achieving orthopedic correction. Distal movement of maxillary molars can also be achieved simultaneously. The gained space from distalization can be used to retract the maxillary premolars, canines, and incisors into a Class I occlusion. 

This case report describes a 9-year-old female who presented with a Class II Division 1 malocclusion and maxillary incisor proclination (Figures 1 and 2). The maxillary second molars were still in the tooth-bud stage when a cervical-pull headgear was delivered, and a mandibular lingual holding arch appliance was fitted (Figure 3).

Etiology and diagnosis
The patient had a brachycephalic facial form with incompetent lips and no significant facial asymmetries (Figure 1). Intraorally, she had Angle Class II molar relation on both sides (Figures 1 and 2). She had a 10-mm overjet, 50% overbite, mild mandibular crowding, and coincident maxillary and mandibular midlines. Soft tissue analysis revealed that she had normal upper lip, retrusive lower lip, and retrusive chin (Figure 1 and Table I). No abnormalities were noted on panoramic radiograph (Figure 3). Clinical examination did not reveal any temporomandibular joint problems. Periodontal health was found to be within normal limits.

The pretreatment lateral cephalometric radiograph (Figure 4) and analysis (Table I) demonstrated a skeletal Class II malocclusion (A point, nasion, B point [ANB] = 7°). The maxillary
incisors had a 28° angle relative to the nasion-point A line, and the mandibular incisors had a 106° angle relative to the mandibular plane. The Frankfort mandibular plane angle (FMA) of 22° and sella nasion (SN)-mandibular plane (GoGn) angle of 32° revealed the hypodivergent skeletal pattern. A 1-mm space requirement in the maxillary arch and a 3-mm space requirement in the mandibular arch were found on study model analysis.

**Treatment Objectives**

1. Reduce maxillary incisor proclination
2. Relieve maxillary and mandibular crowding
3. Correct the Class II malocclusion and establish a Class I molar and canine relationship
4. Achieve a well-intercuspated occlusion
5. Achieve ideal overbite and overjet
6. Improve the soft-tissue profile and skeletally hypodivergent profile

**Alternative Treatment Plans**

The patient’s chief concern was “my front teeth stick out too far.” Treatment alternatives for this case were: (1) distalization of maxillary molars using a cervical-pull headgear, (2) distalization of maxillary molars using an intraoral distalization appliance, (3) extraction of maxillary first premolars only, (4) extraction of maxillary first premolars and mandibular second premolars, and (5) fixed orthodontic treatment with growth modification by using a functional appliance.

Due to the patient’s parents’ opposition to extraction of healthy teeth for orthodontic purposes and the patient’s willingness to wear a headgear, the use of a cervical-pull headgear was evaluated as a treatment plan option. This treatment plan was selected by patient and her parents.

**Treatment Progress**

Treatment was initiated by delivering a cervical-pull headgear to the patient. Patient was instructed to wear it during the evening hours and night-time only. A force of 12-16 ounces (350 to 450 gm) was applied per side. A lingual holding arch appliance was cemented in mandibular arch to preserve the ‘E’-space.

After 6-months of headgear wear, a Class I molar relationship was achieved on both sides. Pre-adjusted fixed appliances (0.022 × 0.028-inch, MBT system®) were placed in both arches. Initial leveling and alignment was carried out with 0.014 nitinol and 0.018 nitinol wires. Subsequently, 0.018 stainless steel wire with molar-stops was placed in the maxillary arch to prevent any mesial movement of maxillary molars. Pull from the transseptal fibers helped in the distal drifting of maxillary canines and premolars during this period. Complete distalization of maxillary canines and premolars was achieved by using continuous arch wires and power chains. The headgear wear was discontinued, and the mandibular lingual holding arch appliance was removed after 13 months of overall treatment. After a Class I canine relationship was achieved on both sides, 0.017× 0.025 inch TMA® (Beta-Titanium alloy) arch wire with "tear-drop" loops was used in the maxillary arch to retract the anterior teeth. Detailing bends were placed in 0.018 stainless steel wires to improve interdigitating of the teeth. Coordinated arch wires and settling elastics were used to gain maximum intercuspation of the teeth. The orthodontic appliances were removed after 22 months of treatment. Hawley retainers were fabricated for retention in both arches.

**Treatment Results**

The patient’s chief concern of maxillary incisor proclination was resolved while ideal overbite and overjet were achieved. Posterior occlusion was improved to a bilateral Class I molar relationship. Class I canine relationship was also achieved on both sides (Figures 6 and 7).
Maxillary growth was noted to be in a forward direction predominantly (Figure 10). Significant mandibular growth was also observed in a forward direction. Extrusion of maxillary first molars was noted, and mandibular first molars demonstrated significant compensatory mesial and occlusal movement as a response to skeletal mandibular growth. The maxillary incisors were retracted significantly as compared to their pre-treatment position. The mandibular incisors also showed reduction in their proclination (Figure 10). Facial esthetics were improved primarily due to the reduced convexity of the soft-tissue profile. Lower lip position improved significantly with respect to the E line (Figures 9 & 10 and Table I). Satisfactory root parallelism was achieved as noted on post-treatment panoramic radiograph (Figure 8). No temporomandibular joint problems were noted.

**Case Retention**

The patient received Hawley retainers for maxillary and mandibular arches.

**Discussion**

Several appliances are available for the correction of Class II malocclusion. Various intraoral molar distalization appliances have been described for non-compliant Class II patients.\(^5\)\(^-\)\(^7\) Compliance-dependent appliances such as headgears\(^8\) or functional appliances\(^9\)\(^-\)\(^12\) are recommended for the treatment of skeletal Class II malocclusions especially when growth modification is desired.\(^13\)

A cervical headgear is made up of a neckstrap connected to a facebow. Extraoral force is applied to the maxillary first molars via a facebow, and a headcap or a neckstrap is used for anchorage. This appliance produces a distal and downward force against the maxillary teeth and the maxilla thereby causing extrusion of maxillary first molars.\(^13\) Due to the reduced lower anterior facial height and horizontal growth pattern of this patient, cervical direction was selected as the appropriate direction of pull of the headgear. Protrusive mandibular incisor position favored a headgear over functional appliance treatment in this case, as functional appliances tend to move mandibular incisors forward but headgear treatment does not.
Skeletal Class II correction is obtained as the mandible grows forward normally while similar forward growth of the maxilla is restrained. Therefore, a favorable mandibular growth is a necessary part of the treatment response. In this case, a significant forward and downward direction of mandibular growth helped produce a successful outcome (Figure 10).

Cangialosi et al performed a cephalometric appraisal of the treatment effects of non-extraction edgewise therapy combined with cervical headgear on Class II, Division 1 malocclusions. Their findings reported a significant inhibition of forward growth of the maxilla, reduction of flaring of the maxillary incisors, reduction of the facial convexity, and extrusion and mesial movement of maxillary and mandibular first molars. Similar findings were noted in this case also. They also observed that the overall results tend to indicate the efficacy of this treatment modality in the treatment of the Class II, Division 1 malocclusion. This case report confirms their observation.

Conclusions
A cervical-pull headgear is an effective and non-invasive appliance for obtaining desired orthopedic effect. Skeletal Class I relation was achieved. Improvement in soft-tissue profile and decrease in facial convexity were noted due to a favorable mandibular growth pattern. Patient presented pleasing smile esthetics at the completion of treatment.

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References

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