

Skeletal and dentoalveolar changes following the use of an occlusally bonded maxillary protraction headgear appliance in patients born with cleft lip and palate



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Maxillary hypoplasia is a common finding in patients with cleft lip and palate (CLP). This study evaluated the skeletal and dentoalveolar changes in patients with CLP treated with an occlusally bonded maxillary protraction headgear (PHG) appliance.

A total of 267 consecutive patients (1995–2012) treated with a PHG appliance were reviewed. In all, 40 patients with CLP (mean age 7.70 years) met the inclusion criteria. Mean treatment duration was 7.5 months with a mean force of 405 g per side. X- and Y-axis displacement for 38 lateral cephalometric landmarks was recorded at pretreatment (T_0), following removal of PHG (T_1), and at 1.5 years follow-up (T_2).

From T_0 to T_1 , A-point advanced by +2.48 mm ($p < 0.01$), UIE advanced by +4.91 mm ($p < 0.01$) and B-point moved posteriorly by –2.03 mm ($p < 0.01$) and inferiorly by –3.86 mm ($p < 0.01$). During the same time interval, the ANB angle changed from 0.08° to 3.77° ($p < 0.01$). At 1.5 year follow-up, A-point moved posteriorly by –0.28 mm ($p > 0.05$), B-point moved anteriorly by 3.69 mm ($p < 0.01$) and the ANB angle decreased to 0.51° ($p < 0.01$).

A PHG appliance with a mean 810 g of force resulted in 54.60% skeletal and 45.40% dentoalveolar advancement. At 1.5 years (T_2), the maxillary position was stable with minimal anterior growth; however, the mandible showed significant anterior growth contributing to reduction of the ANB angle. (Semin Orthod 2017; 23:279–294.) © 2017 Elsevier Inc. All rights reserved.

Introduction and literature review

Maxillary hypoplasia is a common finding among patients born with cleft lip and palate (CLP). Reasons for maxillary hypoplasia in patients with CLP are multifactorial; including an

underlying intrinsic primary deficiency of hard and soft tissue, palatal surgery with consequent scarring and tethering back of the palate during the years of active midface growth¹ and the inherited craniofacial morphological characteristics of the patients' parents.^{2–5}

Treatment becomes a necessary option due to the need to build a functional occlusion, intercept impending problems of eruption resulting from malpositioned tooth buds, and improve facial esthetics during the critical psychosocial preadolescent years.^{6–8}

Over the past years there has been much debate about the timing^{9–14} and alternative methods^{15–18} for the treatment of maxillary hypoplasia in the populations both with and without CLP. Protraction headgear (PHG) therapy (anterior pull headgear or face mask

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therapy) remains the standard of care for the treatment of mild maxillary hypoplasia with associated Class III malocclusion and is viewed as a viable and effective nonsurgical treatment option.^{19–34}

While PHG outcome studies have been extensively performed and reported in patients without CLP, relatively few such studies have been performed in populations with CLP. Very specific and limited variables have been studied, i.e., the effect of cleft types,³⁵ treatment timing,^{36–38} outcomes in isolated demographic groups^{6,39} and more generalized or weaker samples.^{40,41} However, the literature is lacking definitive treatment age analysis, 12 months or longer follow-up analysis, and skeletal versus dentoalveolar effects of PHG therapy in patients with CLP.

The purpose in this study was threefold: (1) to evaluate the skeletal and dentoalveolar changes following the use of an occlusally bonded maxillary protraction headgear appliance in patients born with CLP, (2) to determine the stability of skeletal and dentoalveolar changes through a follow-up period of 1.5 years postremoval of the PHG appliance, and (3) to compare the treatment outcomes between an early treatment group (age 4–7 years) and a late treatment group (age 8–13 years).

Materials and methods

Institutional review board approval for this study was obtained from New York University Langone Medical Center. The retrospective cohort sample included 267 consecutively enrolled patients who were treated with an occlusally bonded maxillary protraction headgear appliance. All

patients were treated at the NYU Institute of Reconstructive Plastic Surgery by two orthodontists (B.H.G. and P.R.S.) between the years 1995 and 2012. Although the study includes patients from NYU Medical Center, not everyone in the sample population received NasoAlveolar molding (NAM), as earlier treatment could have occurred elsewhere before coming to NYU for protraction headgear treatment. Each usage of an appliance was treated as an individual patient regardless of whether the patient had previously been exposed to protraction headgear therapy.

In all, 40 patients met the following inclusion criteria: (1) The patient must have received PHG therapy with an occlusally bonded maxillary protraction headgear appliance. (2) The patient must have been a nonsyndromic patient born with cleft lip and palate. (3) Lateral cephalometric radiographs must have been present in the records within 6 months of each desired time point. (4) There must have been no noted compliance issues in the patients' progress notes.

The sample had 27 males and 13 females ranging in ages from 4.03 to 13.58 years at the time treatment began (mean age 7.70 ± 2.5 years). A complete breakdown of the sample into gender, cleft type, and age is shown in Table 1. Of the 40 patients in the sample, 19 were treated with simultaneous classical palatal expansion and 21 without.

The sample was further divided into two groups: Group 1 includes the early treatment group composed of 23 children, ages 4.03–7.91 years (mean age 5.93 ± 1.09 years). Group 2 includes the late treatment group composed of 17 children, ages 8.15–13.58 years (mean age 10.09 ± 1.75 years).

Table 1. Total sample demographics including age ranges, gender, and cleft type

Gender	Cleft type	Age range		Total (cleft type)	Total (gender)
		4–7 y	8–13 y		
Male	BCLP	8	6	14	27
	UCLP	5	8	13	
	Incomplete	0	0	0	
	CP	0	0	0	
Female	BCLP	2	1	3	13
	UCLP	3	1	4	
	Incomplete	2	1	3	
	CP	3	0	3	
Total		23	17	40	40

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