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Changes in nose symmetry in unilateral cleft lip and palate treated by differing pre-surgical assistance: An objective assessment of primary repair☆

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ABSTRACT

Backgound: Residual deformity of the nose, not lip, continues to be the greater challenge in UCCLP rehabilitation. Platform distortions often re-emerge following primary reconstruction revealing the stereotypical cleft-nose. Nasal alveolar molding reduces nose asymmetry. However, this study applies directional mechanics to the underlying platform distortions and soft tissue nose, introducing a novel device addressing the distorted septo-premaxillary junction.
Methods: Retrospective assessment of 47 UCCLP patients by 2-dimensional photographic analysis with 24 subjects treated by dento-maxillary advancement (DMA) and nasal septum button-head pin (NSBP), 17 having nasal molding (NM), compared to 23 subjects without nose treatment, 16 with DMA and 7 with passive plates. Measurements were assessed by *t* tests, ≤05 confidence.
Results: Frontal view: nose-treatment sample achieved ideal ala-bases vertical symmetry ($p = 0.00065$ & 0.00073); significantly improved ala-rims "slump" angle ($p = 0.0071$). Both samples had nose positioning within the facial frame like non-cleft population. Sub-nasal view: significant differences were for columella angle ($p = 0.0015$), nares "offset" ($p = 0.002$), and columella symmetry ($p = 0.022$) with nose-treatment achieving near ideal columella symmetry score (0.92) vs. (0.81).
Conclusions: NM and the novel NSBP procedures integrated with the platform correction effect of the DMA successfully treated at three distorted anatomic-levels native to UCCLP to improve nasal aesthetics.

1. Introduction

Facial esthetics plays a key role in social attractiveness (Shaw et al., 1985; Asher-McDade et al., 1992); nasal form and function are of great concern to patients with *unilateral complete cleft lip palate* UCLP (Asher-McDade et al., 1992; Mani et al., 2013). UCLP nasal platform has a stereotypic pattern of distortions with deviation of nasal septum with height foreshortening, reverse bending of the pre-maxilla, and asymmetry in antero-posterior, vertical, and lateral positions of the piriform rims at prenatal age (Latham, 1990), at postnatal age 3 month (Zemann et al., 2002), and at adult age 20 years (Wu et al., 2013).

Although innovative primary repair (Miyamoto et al., 2007) and bone grafting for nasal support are advocated (Nagasai et al., 2009; Kau et al., 2011), they are without long-term effect for piriform symmetry, nasal morphology, or nostril shape (Sander et al., 2011; Tai et al., 2000; Feichtinger et al., 2006; Wu et al., 2008). Obscured by unstable reconstructive procedures, the

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platform distortions re-emerge and sustain the discernible stigmata of the cleft nasal deformity residing in three-dimensions and three tissue layers (Wu et al., 2013; Bardach and Cutting, 1990; Cohen et al., 2003).

The Hotz plate (Hotz and Gnoinski, 1976), commonly used in Europe does not improve nose aesthetics (Yamada et al., 2003). Marginal improvements on nasal aesthetics reported by Matsuo et al. (1989) use isolated nose stents, and more recently more effective results by others (Berggren, 2001; Monasterio et al., 2008) employ isolated nasal elevators. Attached to classical alveolar molding plates (McNeil, 1950, 1954; Burston, 1958), nasal molding devices evolved between 1991 and 2001 (Dogliotti et al., 1991; Grayson et al., 1993; Grayson and Santiago, 1997: Grayson et al., 1999; Grayson and Cutting, 2001) as "Naso-alveolar molding" intended to align cleft defect margins, reduce columella, nasal tip, and ala rim asymmetries; beneficial and stable effects on nasal form are claimed and stable long-term (Maull et al., 1999; Lee et al., 2008; Barillas et al., 2009).

Consistent cleft-side ala base support is established for cleft lip and nasal reconstruction using *dentomaxillary advancement* (DMA) appliance therapy according to Latham (Millard, 1990; Latham, 1980; Spolyar et al., 1992, 1993), however, without reasonable improvement in the stubbornly abnormal nasal septum and pre-maxilla native positions (Spolyar et al., 1992). This equally crucial anatomic area of the cleft maxilla, considering nose aesthetics, is constantly deformed. There is no presurgical means described that yet approaches the cleft deformity at that level. Although, primary surgical correction of nasal septal deviation for anterior centering has been described (Janiszewska-Olszowska et al., 2014).

The aim of the present study is to evaluate nose symmetry in UCLP postoperatively after incorporating two novel pre-surgical devices that attempt to correct septo-premaxillary and nasal distortions assessed by 2D-photography like other studies (Brusse et al., 1999; Gotfredsen et al., 1999; Russsell and Tompson, 2009; Kim et al., 2009; Pigott and Pigott, 2010) without need for subjective rating (Asher-McDade et al., 1991; Lo et al., 2002; Iliopoulos et al., 2014), or specialized equipment (Fisher et al., 1999; Ferrario et al., 2003; Nkenke et al., 2006).

2. Material and methods

This retrospective study assesses the effect of those presurgical devices on nose symmetry compared with a patient collective treated by Latham appliance or a passive orthopedic plate.

2.1. The nasal devices

Introduced by the first author (JLS), the *nasal septum buttonhead pin* (NSBP) is a tool to reduce septum deviation (Fig. 1); it is placed through the non-cleft naris and tether-chained to the Latham DMA (Fig. 2). *Nasal molding* (NM), designed by first author (JLS), is intended to improve nasal distortions and, like NSBP, adding another level of treatment to presurgical therapy (Fig. 3).

Early-on, an unpublished NSBP pilot study of frontal serial cephalographs ($n = 4$) showed the nasal septum deflection angle was reduced by mean 22° from 57° to 35° that would increase nasal height by 3 mm with estimated 11 mm septum length. This finding was consistent with the cross sectional cast study ($n = 4$, treatment and $n = 8$, control) findings from direct measurements for anterior premaxillary descent (3.0 mm) related to the greater segment medial incline angle reduction (6°). This study gave substance for photographic analysis of clinically detectable nasal feature changes.

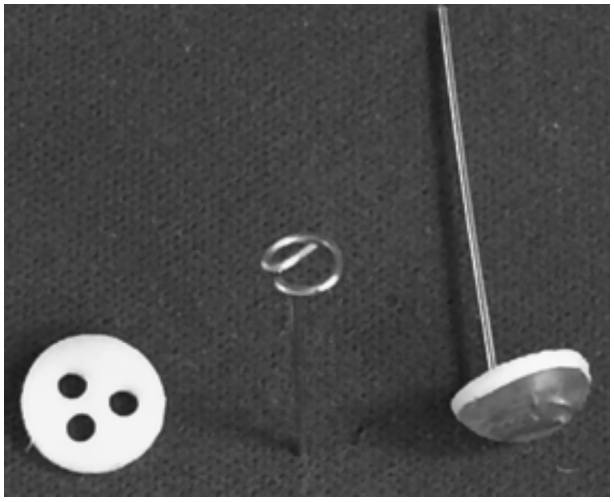

Fig. 1. View of *nasal septum button-head pin* (NSBP). The button is made with 1 mm Teflon sheet material using 7 mm leather punch and three (3) holes added. A 0.022 (0.58 mm) ss wire is bent to form a flat-end helix with the length of the shaft passing through one hole, the other two used to secure the button-head to the helix using .014 (0.37 mm) ligature wire. Light cured acrylic "gel" is added to the button-head making it more secure. The pin is trimmed to 25 mm length and end sharpened. The NSBP materials withstand all methods of sterilization.

2.2. Patients and cohorts

The patients of first author (JLS) had primary surgical repair at Children's Hospital of Michigan, Detroit; Providence Hospital, Southfield & St John/Providence Park, Novi and William Beaumont Hospital, Royal Oak, Michigan, USA.

Cases were excluded with associated syndromes, incomplete clefts, Simonart's band, secondary nose surgery beyond the primary repair, prior orthodontic treatment, and photos or images of poor quality or view.

Cases included were Caucasian or Non-Caucasian subjects with isolated complete UCLP with or without primary or secondary

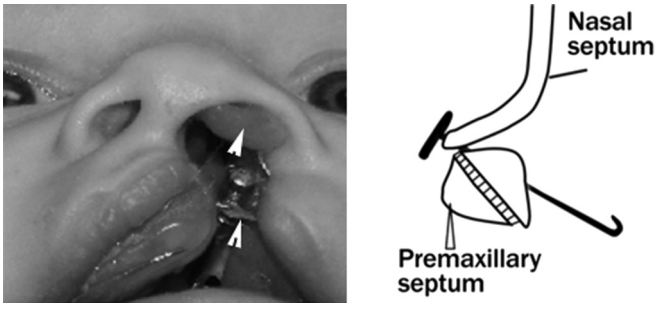

Fig. 2. Application of the NSBP: (*left*) infant UCLP, age 10 weeks shows *nasal molder* (NM) (*top arrow*) and NSBP properly positioned behind premaxilla (*bottom arrow*) with elastic chain attached. Gentle initial tensioning is used, since force strain exceeding growth adaptation can lead to excoriation, dehiscence, or focal distortion of the septum. Light continuous force is sufficient. (*right*) Frontal schematic shows NSBP positioning to nasal septum (NS) and premaxilla. Pin enters through non-cleft naris placed dorsal and beyond about 7 mm (depth of premaxillary alveolus) and oriented about 60° to caudal exiting intraoral at side opposite and behind alveolar premaxilla. In placing NSBP it is important to engage the premaxillary septum bone where the sharpened pin cannot push through; a 0.9 mm dia. hand drill is used to then make a pin-hole for the NSBP. When the button-head is drawn against the septum, the pin is trimmed to 10-mm length with end turned to form a hook. Elastic chain (Rocky Mountain® Orthodontics, Denver CO, USA) attaches from hook to a button-cleat on appliance *lesser segment* (LS). Tensional force is not more than 50 g with one-link activation after three weeks, as natural tensioning occurs by LS growth descent exceeding NS descent.