# A Review on the use of Presurgical Infant Orthopedics to Improve Speech Sound Development in Cleft Lip and Palate Children


Plattsburgh
STATE UNIVERSITY OF NEW YORK

**Charlotte J. Miller**

**Department of Communication Sciences and Disorders, Plattsburgh State University of New York**


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## Research Question

Does use of presurgical infant orthopedics (PSIO) improve speech development by facilitating correct articulatory place and manner to improve speech intelligibility?

## Reason for Research

The use of PSIO is controversial amongst the interdisciplinary team that works with cleft lip and palate patients. Many surgeons and orthodontists favor delaying hard palate repair. Speech-language pathologists (SLPs) advocate for earlier repaired cleft palates. SLPs should know the effects of PSIO devices on speech sound development regarding its ability to minimize compensatory articulations and improve speech intelligibility.

## Background

Cleft lip and palate is one of the most common birth defects in the United States that affects one out of every 700 live births (Vinson, 2016). Typically, infants receive their first corrective surgery around three to six months of age. This surgery repairs their cleft lip. A few months later, between nine to 18 months of age, infants undergo surgery to repair their cleft palate (Zajac and Vallino, 2017).

When using PSIO, infants receive surgery of their lip around three to six months of age and a palatoplasty (repair of the soft palate) around nine to 18 months of age (Zajac and Vallino, 2017). Repair of the hard palate is significantly delayed until the child is five to eight years of age (Willadsen, 2012).

In terms of speech sound development, the intent of PSIO devices is to align maxillary segments. Thus, creating a more normal oral cavity to facilitate the experimentation of speech sounds (Konst, Weersnik-Braks, & Rietveld, 1999). There are two main types of PSIO devices, active (fixed) and passive (removable). The use of PSIO devices obturates the cleft in the palate; therefore, leading professionals to believe speech sound development will be promoted using these devices.

## Types of PSIO

### Passive Appliances

Passive appliances maintain the distance between the two maxillary segments while an external force is applied to reposition the segments posteriorly. Examples of these devices include the Hotz appliance (1976) and the Nasoalveolar Molding appliance (1993) (Esenlik, 2015).

*Figure* 1. Hotz Appliance (Vinson, 2016)

### Active Appliance

Active appliances are fixed intra-orally and apply traction through mechanical means such as chains, screws, and plates. Examples include the Latham device (1975) and the McNeil device (1950) (Esenlik, 2015).

*Figure* 2. Latham device (Latham, n.d.)

## Introduction

Individuals with cleft lip and palate have difficulty creating the intraoral pressure needed for speech sound production (Willadsen, 2012). As a result, children typically develop compensatory articulations to make up for velopharyngeal port dysfunction. Compensatory articulations are maladaptive speech production patterns that alter the placement and manner of articulation. Thus, affecting speech intelligibility.

*Place of articulation*: Children with cleft lip and palate resort to "extreme" vocal tract productions. They often avoid consonants that require use of the hard palate and produce speech sound using the glottis and/or back of the oral cavity (Lohmander, Lillvik, & Friede, 2004).

*Manner of articulation*: Oral phonemes that require a build-up of pressure (stops, fricatives, and affricates) are difficult for children with cleft lip and palate to produce (Mandulak, Baylis, Thurmes, & 2011).

*Speech Intelligibility*: Speech intelligibility refers to how much of what a child says is understood by listeners. Speech intelligibility is negatively affected by the incorrect placement and manner (release of airflow) of articulation in the oral cavity (Mandulak, Baylis, Thurmes, & 2011).

## Participants and Methods

Participants with a unilateral cleft lip and palate between the ages of 12 months to 17 years of age were included in this review. Half of the participants received PSIO devices (PSIO+) and the other half did not (PSIO-). Participants in the PSIO+ group were fitted with passive devices within three weeks of birth. Researchers collected representative speech samples using audio recordings to assess participants on their, place and manner of articulation (Konst, Weersnik-Braks, & Rietveld, 1999; Hardin-Jones et al., 2002; Lohmander, Lillvik, & Friede, 2004) and speech intelligibility (Karling, Larson, Leanderson, & Henningsson, 1993; Konst, Weersink-Braks, Rietveld, & Peters, 2000). T-test scores from the PSIO+ group were compared to those from the PSIO- group regarding these variables.

*Figure* 3. Unilateral cleft lip and palate (Centers for Disease Control and Prevention, 2015)

## Table 1: Type of surgery

| Study | Cheiloplasty Between 3-6 months | Hard Palate Repaired 1.5 years | Delayed Hard Palate Repair |
|---|---|---|---|
| Karling et al. (1993) | X | X | |
| Konst et al. (1999) | X | | X |
| Konst et al. (2000) | X | | X |
| Hardin-Jones et al. (2002) | | | |
| Lohmander et al. (2004) | X | | X |

## Table 2: Age of assessment

| Study | 12-18 months | 2-5 years | 10-17 years |
|---|---|---|---|
| Karling et al. (1993) | | | X |
| Konst et al. (1999) | X | | |
| Konst et al. (2000) | | X | |
| Hardin-Jones et al. (2002) | X | | |
| Lohmander et al. (2004) | X | | |

## Table 3: Outcome measures

| Study | Intelligibility no benefit | | Place and manner no benefit (oral plosives) | |
|---|---|---|---|---|
| | PSIO+ | PSIO- | PSIO+ | PSIO- |
| Karling et al. (1993) | 59.0% | 50.0% | | |
| Konst et al. (1999) | | | 13.5% | 13.1% |
| Konst et al. (2000) | 45.0% | 33.0% | | |
| Hardin-Jones et al. (2002) | | | 10.4% | 5.8% |
| Lohmander et al. (2004) | | | 31.0% | 28.0% |

## Results

The literature found no short-term benefit in using PSIO devices with regards to place and manner of articulation (Konst, Weersnik-Braks, & Rietveld, 1999; Hardin-Jones et al., 2002; Lohmander, Lillvik, & Friede, 2004). The following studies found that the most common place and manner of articulation between PSIO+ and PSIO- groups were oral plosives. These studies categorized glottal productions as being within the oral cavity. When phoneme placement was further explored, researchers discovered that most plosives were produced in the glottal region.

Karling, Larson, Leanderson, & Henningsson (1993) used experienced listeners to rate the intelligibility of participants who received PSIO devices compared to those who did not. Whereas, Konst, Weersink-Braks, Rietveld, & Peters (2000) used inexperienced listeners to rate speech intelligibility. This study also added a transcription component that was carried out by professional speech-language pathologists to account for intra-rater reliability. Both studies found no long-term benefit in using PSIO in terms of speech intelligibility.

## Conclusion

Speech-language pathologists recommend early repaired cleft palates to improve speech sound development in infants with unilateral cleft lip and palate (Willadsen, 2012). Most research regarding the benefits of PSIO devices have been done from a surgical or orthodontic viewpoint. More research from an SLPs standpoint about the benefits of PSIO devices on speech sound development must be done.

## References


Centers for Disease Control and Prevention. (2015, December 29). *Cleft lip and Palate*. Retrieved from https://www.cdc.gov/ncbddd/birthdefects/surveillancemanual/chapters/chapter-4/chapter4-3.html#fig4.10

Esenlik, E. (2015). Presurgical infant orthopedics for cleft lip and palate: A review. *Jurnalul de Chirurgie,11*(1). doi:10.7438/1584-9341-11-1-2

Hardin-Jones, M. A., Chapman, K. L., Wright, J., Halter, K. A., Schulte, J., Dean, J. A., Havilk, R. J., Goldstein, J. (2002). The impact of early palatal obturation on consonant development in babies with unrepaired cleft palate. *The Cleft Palate-Craniofacial Journal,39*(2), 157-163. doi:10.1597/1545-1569(2002)039<0157:tioepo>2.0.co;2

Karling, J., Larson, O., Leanderson, R., & Henningsson, G. (1993). Speech in unilateral and bilateral cleft palate patients from Stockholm. *The Cleft Palate-Craniofacial Journal,30*(1), 73-77. doi:10.1597/1545-1569(1993)030<0073:siuabc>2.3.co;2

Konst, E. M., Weersnik-Braks, H., & Rietveld, T. (1999). Prelexical development of unilateral cleft lip and palate babies with reference to presurgical infant orthopaedics: A randomized prospective clinical trial. *Clinical Linguistics & Phonetics,13*(5), 395-407. doi:10.1080/026992099299059

Konst, E. M., Weersink-Braks, H., Rietveld, T., & Peters, H. (2000). An intelligibility assessment of toddlers with cleft lip and palate who received and did not receive presurgical infant orthopedic treatment. *Journal of Communication Disorders,33*(6), 483-501. doi:10.1016/s0021-9924(00)00035-6

*Latham* (n.d.). Retrieved from http://www.cleftopedia.com/pre-surgical-techniques/latham/

Lohmander, A., Lillvik, M., & Friede, H. (2004). The impact of early infant jaw-orthopaedics on early speech production in toddlers with unilateral cleft lip and palate. *Clinical Linguistics & Phonetics,18*(4-5), 259-284. doi:10.1080/02699200410001663353

Mandulak, K., Baylis, A., & Thurmes, A. (2011). *Cleft Palate and Velopharyngeal Dysfunction: Evaluation, Treatment, and Problem-Solving* [PowerPoint slides]. ASHA Convention in San Diego, California. Retrieved from http://www.asha.org/Events/convention/handouts/2011/Mandulak-Baylis-Thurmes/

Vinson, L. A., (2016). Presurgical orthopedics in cleft lip and palate care. *Open Journal of Dentistry and Oral Medicine*, *4*(1), 14-19. doi:10.13189/ojdom.2016.040102

Willadsen, E. (2012). Influence of timing of hard palate repair in a two-stage procedure on early speech development in danish children with cleft palate. *The Cleft Palate-Craniofacial Journal,49*(5), 574-595. doi:10.1597/09-120

Zajac, D. J., & Vallino, L. D. (2017). Pre surgical and surgical management. *Evaluation and Management of Cleft Lip and Palate: A Developmental Perspective* (pp. 132-148). San Diego, CA: Plural Publishing.


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