

Research Article

Suction Ability of the Infant with Complete Bilateral Cleft Lip and Palate Using Feeding Plate Modification of Hotz-Kogo

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Abstract:

Cleft lip and palate are abnormalities that often occur in the head and neck, with 65% incidence. The abnormalities are caused by the failure of unification of the segment on the fourth week of pregnancy. Malformation on the lips and palate resulted in hard sucking and swallowing on the infant so that malnutrition occurs early in the infant's life. The purpose of this research is to know the suction ability of the infant with complete bilateral cleft lip and palate using feeding plate modification of Hotz-Kogo and also to know the correlation of the increase of negative pressure with the volume of the fluid sucked.

The study was conducted on 9 newborns at Hasan Sadikin Hospital Bandung. Infants use feeding plate with Hotz-Kogo modified design using hard and soft acrylic resin. Fabrication of feeding plate done in RSGM Unpad laboratory. Negative pressure measurements and infant suction volume were performed for 15 minutes. The first measurement is performed immediately after feeding plate insertion in infants. The second measurement is 7 to 12 days after insertion.

The results showed a decrease in the value of negative pressure and increased volume of suction in the second measurement. The statistical test using t test shows significant result, where p value $< \alpha$ ($p = 0,000092$; $\alpha = 0,05$) for negative pressure and ($p = 0,000042$; $\alpha = 0,05$) for suction volume. Pearson correlation analysis showed there was a correlation between negative pressure and suction volume with negative correlation of 47% or $r = -0,68$, which was statistically significant ($p = 0,0005 < \alpha = 0,05$). Based on the results, it can be concluded that feeding plate modification of hotz-kogo can improve the suction capability of complete bilateral cleft lip and palate infants. Negative pressure has a relationship with the volume of suction with negative correlation.

Keywords: cleft lip and palate, feeding plate, Hotz-Kogo modification, suction ability

I. Introduction

Cleft lip and palate (CLP) is the largest abnormalities that occurs in head and neck, the incidence reaches 65% of head and neck abnormalities.¹ CLP is a formation where the left and right sides of the lips and palate do not coalesce completely during growth period of the fetus, which causes the distance between the two.²

Infant with cleft lip, with or without cleft palate (non syndrome) has difficulty suckling due to structural malformation causing suction and compression to be abnormal. Low weight gain is found early in CLP infant's life due to low intake nutrition. A infant's weight of less than 10 pounds (rule of ten) causes the labioplasty at 3 months of age delayed.^{5,6}

Cleft palate in infants can be closed using an obturator called feeding plate^{6,7} / pre-surgical maxillary orthopedic⁵ / naso alveolar molding^{5,8} / early maxillary orthopedic⁹ / infant orthopedic¹⁰ / surgical orthopedic device. The feeding plate is used to normalize the maxillary arch, normalizes the function of the food path, and improves the posture of the tongue by closing the cleft.^{5,6,7,11} Feeding plate design that is widely used is Hotz plate and Kogo plate. The Hotz plate has a posterior extension to the tip of the uvula cleft, this device provides

better adaptation in the posterior so it is created a more normal swallowing pattern.¹² The Kogo plate has an additional 2-3 mm elevation in the posterior part of the mechanic surface for the purpose of forming close box in sucking process. Close box works to increase negative pressure until the infant is able to suck the maximal milk volume from the bottle pacifier.^{6,3}

Research Maya et al¹⁴, compare Kogo plate and Hotz plate. The result of the research shows that Kogo plate gives more efficient result than Hotz plate. The exact theory of feeding plate design that has an effect on the CBL infant's suction ability has not been found. The purpose of this research is to know the suction ability of the infant with complete bilateral cleft lip and palate using feeding plate modification of Hotz-Kogo and also to know the correlation of the increase of negative pressure with the volume of the fluid sucked.

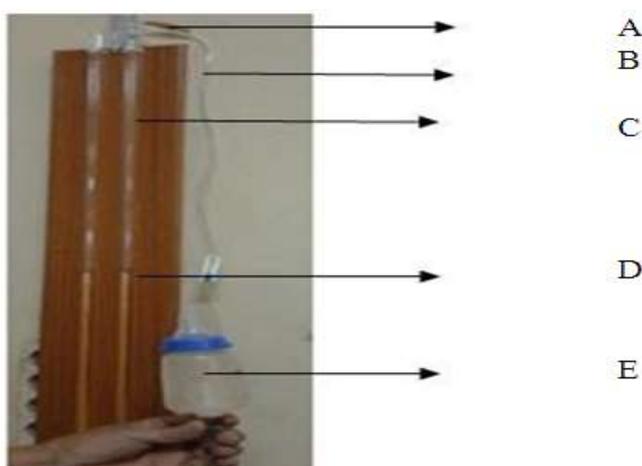
II. Material and methods

The type of research conducted is clinical experimental. The population of this study was a infant born with cleft lip and palate at RSHS Bandung. The sampling technique is consecutive sampling. The inclusion criteria of the research sample were infants with complete bilateral CLP of both men and women; mature infant/ full term infant (born at > 37

weeks) and normal weight at least 2500 grams; infant age 4-21 days; the infant is born with a good general condition (non syndrome) based on the referral of pediatrician and anesthesia specialist; infants have never used a feeding plate before. Exclusion criteria of research samples are the parents refused to cooperate, the infant having breast feeding, suckle directly to the mother, and the infant is sick.

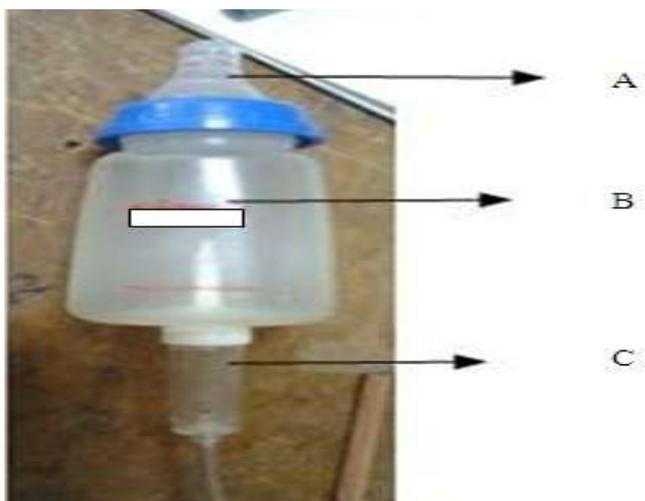
The instrument used to measure the infant's negative pressure during dairy feeding using a dot bottle was developed in conjunction with the Physics Advance Materials Department, Faculty of Engineering, Department of Physics, Institute of Technology Bandung (ITB). This development is based on previously published work of Julie Reid et al (Figure 1)³

Figure 1. Manometer: Tool for Measuring Infant Sucking Pressure.



A. Pipe-resistant rubber that connects the glass pipe and the infusion hose; B. Infusion hose; C. U glass pipe with suction power value graph; D. Limit value 0; and E. Bottle dot

Figure 2. Bottle of Dot used in this research



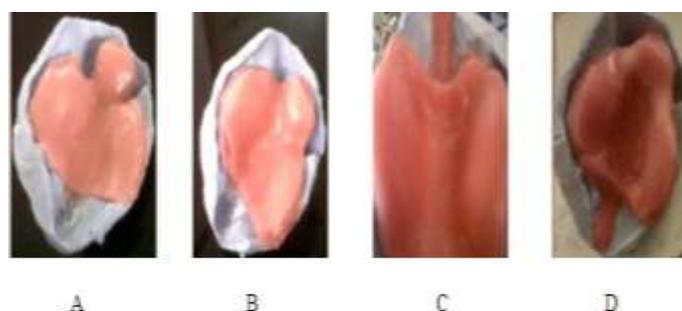
A. Nipple S size; B. Bottle of pacifier; and C An infusion catheter hose connected to a bottle of pacifier

This study was conducted in several stages of visit, starting from the stage of impression, plate fabrication, plate insertion and suction evaluation. infant parents who are willing to

follow this research sign informed consent. Patients who met the sample criteria were referred to the Anesthesia department for infant examination and accompaniment during maxillary impression process. Infants are instructed to fast 2-3 hours prior to impression process. The impression used Polyvinyl Siloxan (Putty) and customized tray special for a infant. The impression process is accompanied by an anesthesiologist, with standard airway management equipment. The patient in supine position, head slightly higher to prevent impression material from entering the throat.

The next stages is fabrication of feeding plate. The feeding plate design is a Hotz-Kogo modification (Figure 3). The feeding plate uses hard acrylic on the mechanical surface of the feeding plate while the soft acrylic on the anatomical surface.

Figure 3. Steps of wax pattern fabrication.



A. The first layer, B. The second layer, C. The elevation of the posterior mechanical part, D. The elongation towards the cleft in the uvula

Patients are instructed to fast 2-3 hours before feeding plate insertion so that patients are hungry and prevent vomiting. The patient is prepared with a comfortable position on the mother's lap, with the neck position upright 15°. Hotz-Kogo modified feeding plate is inserted to the infant until the plate is adaptable and stable in the infant's jaw. The area of the mucobuccal fold and the airway should be freed and the pressing area are removed.

Milk as much as 15 ml prepared in milk bottles. Type of dot that is used is rubber nipple size S. Dot inserted into the infant's mouth, after the infant began to suck normally with approximately 1-2 minutes the operator began to set the time and carefully pay attention to the infant's suction movement, the value on the measuring instruments are recorded every two minutes, a prescribed time measurement of 15 minutes, in accordance with the breastfeeding protocol of good criteria according to Jones.³ The reduced volume of milk on the bottle is recorded after the infant sucks for 15 minutes.

III. Result

During the study period obtained a population of 12 infants, with complete cleft lip and palate. 9 infants fulfilled the inclusion criteria, consisting of 4 male infants and 5 female infants, ages 4 - 21 days.

Table 1 Suction Ability in Infants with Cleft Lip and Palate Bilateral Complete using Hotz-Kogo Modified Feeding Plate.

Infatn	Shortly after Insertion (I)		After 7-12 days (II)	
	Average Pressure [- (mm H ₂ O)]	Volume (ml)	Average Pressure [- (mm H ₂ O)]	Volume (ml)
1	30	10	33	50
2	30	10	35	50
3	25	10	35	45
4	25	8	35	25
5	25	8	30	30
6	20	8	30	25
7	20	10	30	25
8	30	12	35	50
9	30	10	35	40

Table 2. Analysis of Suction Ability in Infants with Cleft Lip and Palate Bilateral Complete using Hotz-Kogo Modified Feeding Plate

	Shortly after Insertion (I)		After 7-12 days (II)		Difference	
	Average Pressure [- (mm H ₂ O)]	Volume (ml)	Average Pressure [- (mm H ₂ O)]	Volume (ml)	Average Pressure [- (mm H ₂ O)]	Volume (ml)
Mean	26	10	33	38	7	28
Std	4.1	1.33	2.42	11.4	2.92	10,53
N	9	9	9	9	9	9
T-test					7.20	8.04
P-Value					9.22E-05	9.22E-05
					sign	sign

Statistical analysis used to see the relationship between negative pressure and suction volume was Pearson correlation analysis with t test statistic test. (Table 3) The analysis shows that there is a correlation with negative correlation of 47% or $r = -0.68$, which is significantly statistically significant.

Table 3 Analytical test of Relationship between Negative Pressure and infants Suction Volume in Infants with Cleft Lip and Palate Bilateral Complete using Hotz-Kogo Modified Feeding Plate.

Variable	r	t test	P value	Test Result	r ²
Negative pressure and volume	-0,684	-2,480	0,0005	significant	0,47

IV. Discussion

Infants using Hotz-Kogo modified plate design in this study had a suction capability with negative pressure ranging between -15 and -35 mm H₂O shortly after feeding plate installation, then -25 and -45 mm H₂O on the second visit. The average suction volume produced by the average infant was 9.56 ml in 15 min (velocity 0.63 ml / min) in the first measurement. On the second measurement the average was 37.8 ml in 15 min (speed 2.52 ml / min).

According to Selley et al¹³, that sub atmospheric pressure between -75 and -150 mm H₂O was produced during normal infant intake without abnormalities. Kogo¹³ studied in ten infants with bilateral and unilateral cleft lip and palate, shortly after feeding plate installation, negative pressure was measured between -50 and -60 mm H₂O.

The results of this study had a smaller range of negative pressure values compared to the negative pressure values of Kogo et al.¹³ Based on the authors' analysis, although the plates may form an alveolar arc close to normal and close the gap in the ceiling of the oral cavity, the hermetic seal may not always be perfectly formed and stable between the lips and nipples when the baby sucks. This causes the infants difficult to form a strong suction to remove the milk liquid from the bottle dot.¹⁵

Hermetic failure of lips and nipples seal in this study according to the author because of the form of abnormalities that divide the lips into three parts with a position that is not parallel to generate space between the three parts. The mother or baby sitter should attach a nipple to the infant's lips to form lips and nipple contact. This condition can not be stable, because of the movement of the infant and the way the mother or caregiver holds bottles that could have changed during the process of breastfeeding. This is based on Prah¹⁰ claim that nipple stabilization is difficult in infants with cleft lip and palate which makes it difficult to maintain negative pressure due to airflow passing through the gap.

All of the infant samples in the second test used a feeding plate with a button in the premaxilla section. Button is paired to position the premaxilla into a central position and according to the normal arc. Indirectly, the button will slightly inhibit the nipple to further enter into the infant's mouth cavity. This can be controlled with the skill of the mother or the baby sitter directing the nipple position, the nipple must be in the 90 ° position of the infant's face position.¹⁶

This study also analyzed the relationship between negative pressure and suction volume. According to statistical analysis there is a relationship between the two with a negative correlation (-), meaning that if the negative pressure value

formed decreases then the suction volume will increase, and vice versa also the negative pressure value is increased then the suction volume will decrease.

The above is different from the research conducted Geddes et al.¹⁷ in his study of 20 infants. The results suggest that there is no relationship between the volume of suction produced by infants with a decrease in the value of negative pressure in the oral cavity.

The average decrease in the value of negative pressure and the increase in mean volume of suction in all infants occurred in the second measurement that is 7-12 days after plate installation. This shows the process of tolerance or reflexes of tissue in the oral cavity of infants positively receiving and supporting Hotz-Kogo modified feeding plate. The interesting thing about this result is that the decrease in negative pressure on the second visit is not very significant, but there is a considerable increase in the volume of suction.

This is because, firstly: the infant has begun to be able to combine positive and negative pressure.³ The suction volume obtained by an impure baby is produced by a negative pressure (suction) only, but also generated by a positive (compression) pressure.³ Infant performs compression with pressing the nipple,⁴ can use tongue, alveolar ridge - that has been formed or hard palate feeding plate, this is indicated when testing the volume of milk decreases in the bottle but the value changed on the manometer moves down the line 0 (positive pressure).¹⁶

Second, adaptation factor of mouth tissue and increasing of infant age based on writer's observation can increase the frequency of sucking even with negative pressure that is not maximal or not always can be maintained. Increasing the frequency of infant sucking directly can also increase the volume of suction obtained by the infant. This sucking frequency change is visible on the second visit, that is, the infant sucks regularly and calmly until he feels full and stops. This is different from the first visit that some infant suck forth, possibly because the infant is still trying to adjust to the feeding plate (foreign body) that has just been paired.

Hotz-Kogo modification design is able to give good adaptation in the posterior part of the palate. This is indicated by the absence of aspiration and regurgitation at the time the infant suckles, so the baby is easy to swallow without any liquid milk coming out of the oral cavity. This is in line with what Reid et al.³ that the posterior closure location of the soft palate cleft is an important factor in infants being able to suck.

V. Conclusion

Based on the results of the study it can be concluded that the use of Hotz-Kogo modified feeding plate can improve the suction capability in infant with complete bilateral cleft lip and palate. Negative pressure has a relationship with the volume of suction with negative correlation.

VI. References

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