The selective grinding prosthetic feeding aid frequency influence towards premaxilla position on infant with complete unilateral cleft lip and palate

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Abstract

Objective: The purpose of the research was to analyze the influence of selective grinding frequency towards premaxilla position of infant with complete unilateral cleft lip and palate using prosthetic feeding aid.

Material and Methods: Ten infants with complete unilateral cleft lip and palate with wide alveolar cleft and rotating position of premaxilla were treated with prosthetic feeding aid. Impression was done twice to each subject before and after prosthetic feeding aid placement. The photograph was taken from each working model. Tracing was made on each photograph using photoQuad program on the assigned postulate spots. Adjustment towards the prosthetic feeding aid device was done every two week with selective grinding on the anatomical surface of acrylic on the palatolateral major and anteromedial minor defects,

and relining with soft liner on the labial of anatomical surface was also done. Anatomical surface selective grinding was not exceeded 1–1.5 mm on every visit. The correlation analyze between selective grinding frequency of prosthetic feeding aid and premaxilla position used the Pearson correlation coefficient.

Results: The correlation analysis between selective grinding prosthetic feeding aid frequency with premaxilla position on infant with complete unilateral cleft lip and palate have positive correlation with value of 23% or r=0.479 and t-count=1.544 or p-value=0.1611.

Conclusion: The more frequent the selective grinding on prosthetic feeding aid, the higher the premaxilla position change will increase towards midsagittal.

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Introduction

Complete unilateral cleft lip and palate is a condition where lips and palate are not perfectly merged in one side so there is a distance between both sides. Complete unilateral cleft lip and palate involves a hard palate, soft palate, alveolar ridge and lip on one side.[1] Maxilla segment on complete unilateral cleft lip will split into two parts, minor segment on the clefted side and major segment on the unclefted side.[1,2]

Infant with complete unilateral cleft lip and palate has an asymmetry face caused by deviation from the nasal tip. The nasal tip is deformed and becomes flat. Besides that, the premaxilla will rotate to the outside.[2,3] The minor segment of maxilla will experience a hypoplastic and retroposition, furthermore philtrum and columella will be retracted on one side and tilted on the unclefted side. The orbicularis oris muscle is disconnected on the cleft lip area. The ala nasi on the unclefted side will be concaved and pulled horizontally.[2–4]

Infant with cleft lip and palate will experience difficulties to get nutrition because of the unclefted anatomy structure, which is why the prosthetic feeding aid (PFA) construction is needed. The PFA is a device that is used for the patient before the cleft

unification surgery. The advantage of PFA are the reduction of cleft width, palate stimulation growth, increase of the maxilla curve growth, increase of the face and infant growth, increase of the occlusion, breast milk feeding, speaking, and hearing growth, the oral cavity tissue development and growth, and maintain the tongue in a good position.[2,5]

The Plat Hotz is a passive type orthopedic plat that aligns the cleft segment with the help of extra-oral strapping and the use of plaster slowly. This device was made from the combination of hard and soft acrylic. It covers the alveolar segment passively and elongates/extends on the posterior part toward the uvula cleft tip. This plat gives a good adaptation in creating a normal swallowing pattern. It is used for 24 hours every day and it is only removed when it is cleaned.[6]

On the Kogo design, the 2 mm acrylic elevation was made on the posterior plat. The elevation plays a role in forming a close box. The Hotz-Kogo design modification is a combination from mechanical palatal posterior enhancement and elongation to the cleft on uvula where the design assimilation produces the maximum positive effect on the infant with cleft lip and palate.[7]

Selective Grinding Prosthetic Feeding Aid

The PFA must have a good adaptation and retention on the infant's oral cavity. The infant must be observed for a few minutes after the device installation. The infant must be able to suck without feeling nausea and dyspnea. After the observation the device can be used for one week for first phase adaptation.[8]

On the adjustment phase, anatomy surface is modified so the growth of alveolar major and minor segment can be directed. The purpose of the modification is to reduce cleft width and to make the alveolar major and minor segment closer so that the maxilla's curve is formed well.[8]

The expected movement from PFA is that the segment major moves to palate and minor segment moves towards the major segment. The modification series that was done by PFA are selective grinding and soft liner relining as in figure 1. The selective grinding process is done on major segment of palate of the PFA anatomy surface and on the minor segment of labial of the PFA anatomy surface. A soft liner relining is done on major segment of the PFA anatomy surface for about 1–1.5 mm.[8]

Material and Methods

Research was done on 10 infants with complete unilateral cleft lip and palate with the inclusion criteria as follows: infants that were old enough (more than 37 weeks old pregnancy), minimum weight 2500 gram, born with good general circumstances based on pediatricians referrals.

Research was done in a few visit phase starting from the preliminary examination, preliminary impression phase, a PFA construction, installation, and selective grinding process for every control and the impression phase before labioplasty. The photograph on the working model from preliminary impression and before labioplasty were taken using digital Nikon Coolpix L340 camera. The camera was attached on the tripod and positioned 30 cm perpendicular to the working model and the model was placed on a pad with 7 cm ruler to calibrate every photograph of working model. The photograph calibration technic would convert picture's scale (pixel) into the real distance in metric units (cm). The calibration was done by placing calibration point on 2 spots where the distance was already known and tracing was made on every photograph using photoQuad program on the postulated spots. The linear measurement to get alveolar cleft width that measured from A–A' used centimeter units (cm). An angular measurement to see major alveolar segment was measured from the angle of degree that was created from midsagittal field and the line through point I. The result of angular measurement was in degree units (°). All of the measurement's result was recorded. Besides that, the selective grinding frequency was calculated. Each data from result of measurement and frequency of selective grinding was analyzed by Pearson's correlation

Figure 1 Prosthetic Feeding Aid anatomy surface modification. Green mark: addition of hard acrylic in mechanical surface; Red mark, addition of soft liner on anatomical surface; Grey mark: selective grinding on anatomical surface of acrylic[8]
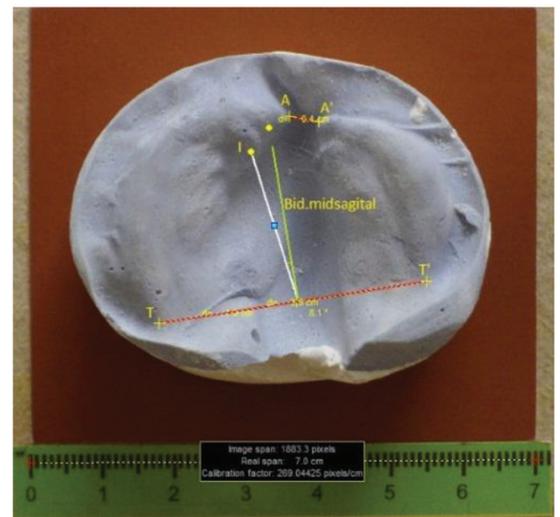
Figure 2 Photograph tracing using PhotoQuad program: A, the most lateral point from major segment; A', the most medial point from minor segment I papilla incisivus; T, maxillary tubercle point from minor segment; AA', cleft distance; TT', intertubercular maxilla line

Table 1   Complete unilateral cleft lip and palate research sample characteristic

| | Sample Group | | | |
| | Number | | Age (days) | Weight (Kg) |
Gender	**N**	**%**	**range**	**range**
Male	3	30%	3–15	2.2–3.3
Female	7	70%	9–49	2.5–4.1
Amount	10	100%		

Table 2   The results of premaxilla angle measurements of infants with complete unilateral cleft lip and palate

| Subject | Cleft Side | Treatment Beginning Age (days) | Labioplasty Reference Age | Selective Grinding Frequency | Premaxilla Position (in degree) | |
					Before	**After**
1	Left	49	110	5	14.9	8.1
2	Right	10	72	2	26.3	26.2
3	Left	19	89	4	34.7	17.3
4	Left	15	117	7	17.1	12.7
5	Right	22	111	9	33.6	22.3
6	Left	9	97	5	12.8	9.5
7	Left	10	115	4	16.4	13.7
8	Left	3	108	4	17.2	13.7
9	Right	9	89	2	26.2	26
10	Left	15	140	6	23.3	14.5
				Average	21.35	16.4

Table 3   Selective grinding prosthetic feeding aid frequency correlation with premaxilla position regression analysis

Selective Grinding Prosthetic Feeding Aid Frequency Correlation with Premaxilla Position Regression Analysis	
r^2	0.230
Adjusted r^2	0.133
r	0.479
Std. Error	5.021
10	Observations
1	predictor variable
Premaxilla Position Change	is the dependent variable
Regression output	confidence interval

variables	coefficients	std. error	t (df = 8)	p-value	95% Lower	95% upper	std. coeff.
intercept	0.0808	4.0597	0.020	.9846	-9.2808	9.4424	0.000
F	1.2019	0.7784	1.544	.1611	-0.5931	2.9969	0.479

Regression model cleft distance change:
$Y_2 = 0,0808 + 1.2019\ F$
with:
Y_2 = Premaxilla Position Change
F = Selective Grinding Prosthetic Feeding Aid Frequency

coefficient analysis. Figure 2 tracing was made on every sample photo using photoQuad program and linear measurement was made according to postulated spots which had been placed. An angular measurement was purposed to see the alveolar major segment's position measured from an angle that was formed by midsagittal field and line which was going through point I. The results were in degree units.

Results

Research was done to 10 infants with complete unilateral cleft lip and palate based on clinical examination including extra and intraoral diagnosis.

The research sample's characteristic; according to table 1 of clinical examination and diagnosis covered 10 infants who filled the criteria. There were 3 male infants (30%) and 7 female infants (70%) with interval age between 3 and 49 days and interval weight between 2.8 and 4.1 kg.

Table 2 the average angle, maximum angle, and minimum angle of premaxilla before treatment were 21.35°, 33.6° and 12.8° respectively. After treatment, the average angle, maximum angle, and minimum angle decreased to 16.4°, 26.2° and 8.1° respectively. According to this result, the average number of premaxilla position decreased in amount of 4.85° after selective grinding prosthetic feeding aid.

Table 3 based on the Pearson's coefficient correlation analysis there was a positive correlation with value 23% or r=0.479 with t count=1.544 or p-value=0.611. The correlation was positive which means the more often selective grinding PFA, the premaxilla position change will increase otherwise, the lower frequency of selective grinding PFA resulted in smaller premaxilla position by changing of complete unilateral cleft lip and palate.

Discussion

On infant with complete unilateral cleft lip and palate, the upper jaw curve is divided into two segments: major segment and minor segment, and involving a soft palate, hard palate, and alveolar ridge.[9] On this condition, the premaxilla segment is pushed more to the anterior. During development, the premaxilla will be more prominent and wide due to the muscle pull around the mouth when it functions.[10]

The research of Pollastri et al.[11] showed that the use of PFA to the patients with cleft lips and palates is playing a role in preventing maxilla segment shifted to the lateral and directing maxilla segment to the desired position. From the analysis

of the result, with the separating of the two maxilla segments and lip muscle, caused an imbalance of muscle that could pull on the tissue around infant's mouth. Furthermore, this caused rotation of maxilla segment, the asymmetry of nasal septum, and wider cleft.

The use of PFA will keep the maxilla segment unshifted when the muscle pulls. When periodically controlled, a selective grinding was done on the medial and palatal from major and minor segment. Also relining and soft liner addition on the anterior segment was done at the same time. These will cause the orthopedic force on the labial segment of the maxilla major and pushed the major segment towards palate. On the area where the selective grinding was done there was an empty space on the palatolateral that became a place where major segment was sliding. The selective grinding was done for 1–1.5 mm. According to Grayson et al.[12] the selective grinding should be done every week for 5 until 1 mm. In this research, the selective grinding was done every two weeks because of distance of patients' residence, and also due to cost and time consumption. The excessive selective grinding will affect the PFA retention, and too much pressure from relining and soft liner will cause injury to the tissue of oral mucosa.

The orthopedic force from relining will cause the premaxilla to return to its correct arch. After the premaxilla is in the correct arch and the major and minor maxilla segment gets closer, labioplasty can be done.

Conclusion

The more often selective grinding prosthetic feeding aid frequency, the higher the change of premaxilla position will increase heading to the right direction of midsagittal position.

Cnflict of Interest

The authors report no conflict of interest.

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