Comparative Study of Cleft Palate Dimension among East Coast Peninsular Malaysian and Caucasian

By:

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BAHAGIAN PENYELIDIKAN & PEMBANGUNAN

CANSELORI

UNIVERSITI SAINS MALAYSIA

Laporan Akhir Projek Penyelidikan Jangka Pendek

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2) **Pusat Pengajian/~~Pusat~~/~~Unit~~ :** PUSAT PENGAJIAN SAINS PERGIGIAN (PPSG) USM.

3) **Tajuk Projek:** "COMPARATIVE STUDY OF CLEFT PALATE DIMENSION AMONG EAST COAST PENINSULAR MALAYSIAN AND CAUCASIAN"

4) (a) **Penemuan Projek/Abstrak**

*(Perlu disediakan makluman di antara 100 - 200 perkataan di dalam **Bahasa Malaysia dan Bahasa Inggeris** Ini kemudiannya akan dimuatkan ke dalam Laporan Tahunan Bahagian Penyelidikan & Pembangunan sebagai satu cara untuk menyampaikan dapatan projek tuan/puan kepada pihak Universiti).*

- PADA KERTAS BERASINGAN -

Abstract

The present study was conducted to compare maxillary arch development of BCLP Kelantan Malay children with a BCLP Caucasian children during the first four years of life and to give a detailed description of maxillary arch development in Kelantan Malay children with a Bilateral Cleft Lip and Plate (BCLP). Samples used in this study consist of seventy six non operated complete bilateral cleft lip and palate (BCLP) children, who were born between 1986 to 2000 and their dental casts were collected from Kota Bharu Hospital and USM Hospital. They were all of Malaysian Malay origin and had no other congenital anomaly other than oral cleft. The data of Caucasian BCLP patient were collected from dental casts at the University Hospital of Nijmegen, Holland (PhD Degree Dissertation in Medical Science of the University of Nijmegen, Netherland). Twenty six children with complete bilateral cleft lip and palate were studied. They were born between 1976 and 1990. They were all of Caucasian Dutch origin and had no other congenital anomaly than oral cleft. The inclusion criteria of the samples were CLP without other congenital abnormality and the exclusion criteria were CLP with other congenital abnormality as well as no present of soft tissue bridges. Dental impressions were taken from all samples and dental casts were made and the points were determined. Maxillary arch dimensions were calculated twice on the dental casts by using Digital Sliding Caliper (Fowler Ultra-Gold, USA). Digital sliding caliper can be connected to the computer by using Fowler digital connector and special data software. Measurement data were transfered to the computer and can be read on the monitor. Measurement of the anatomical and constructed points is determined according to Sillman and Robertson, where C-C′ were intercanine width or, maxillary anterior arch width; T-T′ were intertuberosity width or maxillary posterior arch width and I-Pr2 were total arch depth. Maxillary arch dimensions, were calculated from

the coordinates and were converted into 12 different ages by interpolating data from birth to 48 months. The distance of the interpolated value to the nearest age period was not allowed to be more than two weeks in the first year of life and six weeks thereafter. In order to determine the measurement error from Kelantan control group, 76 dental casts, covering the full range of ages were randomly selected and digitized by same person similar to the method done to the Nijmegen group. To identify the differences betwen the BLCP Kelantan group and the BLCP Nijmegen group at the different ages, the Mann Whitney test and Student t-test was applied. As a coclusion we may state that during the first four years of life maxillary arch development in Kelantan children with a complete bilateral cleft were different with a Caucasian children with complete bilateral cleft. To be concluded that Kelantan BCLP group significantly have more severe cleft distance of the palate compared to Nijmegen BCLP group; and thus the Kelantan Malay children suffer more severe cleft palate deformity.

(b) **Senaraikan Kata Kunci yang digunakan di dalam abstrak:**

Bahasa Malaysia	Bahasa Inggeris
1. DIMENSI ARKUS MAKSILA	1. MAXILLARY ARCH DIMENSION
2. REKAHAN BIBIR DAN LELANGIT	2. BILATERAL CLEFT LIP AND PALATE

5) **Output Dan Faedah Projek**

(a) Penerbitan *(termasuk laporan/kertas seminar)*
(Sila nyatakan jenis, tajuk, pengarang, tahun terbitan dan di mana telah diterbit/dibentangkan).

1. THE MALAYSIAN JOURNAL OF MEDICAL SCIENCES (MJMS), SCHOOL OF MEDICAL SCIENCES, USM.) in process of Review for Publication.
2. Will be presented at 8th National Conference on Medical Sciences held on 8-9 May 2003, Health Campus, USM, Kota Bharu, Kelantan.
3. Presented at IADR-SEA Division (International Association of Dental Research) scientific Meeting at UKM, Kuala Lumpur on 18 January 2003.

(b) Faedah-Faedah Lain Seperti Perkembangan Produk, Prospek Komersialisasi Dan Pendaftaran Paten.
(Jika ada dan jika perlu, sila gunakan kertas berasingan)

1. PENGKALAN DATA (DATA BASE) DARIPADA DIMENSI ARKUS MAKSILA DARI POPULASI PANTAI TIMUR SEMENANJUNG MALAYSIA UNTUK KEGUNAAN PEMBEDAHAN ATAUPUN PENYELIDIKAN. DATA YANG TERSEDIA ADALAH UNTUK CAUCASIAN SEHINGGA PENTING UNTUK DATA BASE ORANG MALAYSIA.
2. SEBAGAI DATA BASE UNTUK PENYELIDIKAN TEKNIK PEMBEDAHAN YANG LEBIH SESUAI UNTUK MALAYSIAN, KHASNYA PANTAI TIMUR.

(c) Latihan Gunatenaga Manusia

i) Pelajar Siswazah 1) MENGETAHUI CARA PENGUKURAN MAXILLARY ARCH DIMENSION ON STUDY MODEL DENTAL. 2) RESEARCH EXPERIENCE

ii) Pelajar Prasiswazah: MEMPELAJARI CARA PENGUKURAN MAXILLARY ARCH DIMENSION PADA DENTAL STUDY MODEL.

iii) Lain-Lain : UNTUK DENTAL SURGERY ASSISTANT (DSA) STAF DAN DENTAL LABORATORY STAF. MENGETAHUI CARA MENYIAPKAN DENTAL CAST STUDY MODEL UNTUK RESEARCH.

6. Peralatan Yang Telah Dibeli:

1. FOWLER DIGITAL SLIDING CALIPER ✓

UNTUK KEGUNAAN JAWATANKUASA PENYELIDIKAN UNIVERSITI

Diluluskan terlebih dahulu kepada persembahan [illegible] di PPSG.

[signature] 18/04/03

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the coordinates and were converted into 12 different ages by interpolating data from birth to 48 months. The distance of the interpolated value to the nearest age period was not allowed to be more than two weeks in the first year of life and six weeks thereafter. In order to determine the measurement error from Kelantan control group, 76 dental casts, covering the full range of ages were randomly selected and digitized by same person similar to the method done to the Nijmegen group. To identify the differences betwen the BLCP Kelantan group and the BLCP Nijmegen group at the different ages, the Mann Whitney test and Student t-test was applied. As a coclusion we may state that during the first four years of life maxillary arch development in Kelantan children with a complete bilateral cleft were different with a Caucasian children with complete bilateral cleft. To be concluded that Kelantan BCLP group significantly have more severe cleft distance of the palate compared to Nijmegen BCLP group; and thus the Kelantan Malay children suffer more severe cleft palate deformity.

Introduction

Cleft lips and palate are developmental anomalies that may occur as an isolation or as a part of a wider pattern of abnormalities in many known syndromes. The essential cause of cleft lip was the persistence of a temporary phase embroyenic development (Robertson, 1983). The formation of an epithelial wall when frontonasal and maxillary processes met to form the upper lip. Normally this wall would disintegrate as it was penetrated by mesoderm but, if it persisted, it might later break down to form a cleft of the upper lip. Cleft palate was considered to arise from a delay in the timing of palatal shelf alignment. The selves were unable to change from the vertical to the horizontal position required for satisfactory fusion or, having become horizontal, but failure to fuse.

The isolated cleft lip with or without cleft palate is a common congenital abnormality that appear to have incidences are different in every race. It is ranging from about 0.4 per 1000 live births in Africans to 4.9 per 1000 in Afghans (Craniofacial Biology Research Group, Dept. of Dentistry, Univ. of Adelaide, 1997). In avarage the incidence of the cleft lip/palate abnormality can be regarded as about 1 case per 1000 live births and be difference in location, type and severity for different race. The incidence in Malaysia, based on the National Oral Health Survey of School Children, Ministry of Health (1997) is 1:941. In Caucasians CLP is more common in males, while among Africans the deformity is more common in females (Robertson, 1983).

At birth, the most striking feature of a baby with a bilateral cleft lip and palate is the protrusion of the premaxilla and the underdevelopment of the columella. This deformity has been demonstrated histologically and anatomically (Heidbuchel, 1997). Further, due to the outward pull of the interrupted circumoral and palatal musculature, lateral alveolar segments are also distorted.

Growth of the Maxilla

Growth of the maxilla is more likely to be affected by the presence of a cleft. In cleft lip and palate individuals the nasal septum is free along its inferior border. Growth is thought to be normal in a horizontal direction but not in vertical. Hayashi *et al.*, (1976) found the upper face height to be less in cleft cases compared with a non-cleft group and they attributed this to interference with growth of the nasal septum in the vertical dimension. The septum always deviated to the non-cleft side. The palatal shelves could be stimulated by an appliance to increase their growth. In unoperated cleft cases, the edges of the cleft roll superiorly and there is infraocclusion of adjacent teeth as well as a tendency for the teeth to incline towards the cleft (Robertson, 1983).

Lambrecht *et al.* (2000) found that the maxillae of untreated Cleft lip and palate patients usually demontrate a protruded position. This may be caused by anterior tongue thrusts when trying to close the cleft while eating or speaking. The horizontal dimension is slightly reduced, whereas the vertical dimension is normal in a majority cases. The breakdown of the results according to the origin of the cleft patient indicates that maxillary development occurs differently among the various races of unoperated cleft lip and palate patients.

Growth of the Mandible

Effects of the cleft on the growth of the mandible are disputed. Krogman *et al.* (1975) found mandibular size the same as normal; but some researchers found a shorter mandible ramus on cleft-group than normal with the hypothesis that changes in mandibular shape were due to a lowered postural position of the mandible under conditions of maxillary deformity.

Occlusal Development

Delayed development of maxillary and mandibular teeth was found by Berkowitz (1978) to be associated with cleft lip and palate. Supernumerary teeth and aplasia occur more frequently with the deformity, supernumerary teeth being more common in the deciduous dentition. The incidence of supernumeraries is greatest in cases of cleft lip only and decreases as the extent of the cleft increases. Incidence of aplasia is lowest in cleft lip only and cleft palate only and increases with increasing extent or complexity of the cleft (Berkowitz, 1978).

Types Cleft Lip and Palate

As in the case of other craniofacial anomalies, there have been many attempts to produce an acceptable classification of clefts, mostly related to location, type or severity. The mildest form is the bifid uvula with no involvement of the hard palate. The most severe forms include complete midline clefting of the palate and bilateral cleft lip. There are many intermediate types of clefts.

1. The major types of lip abnormalities are:

- Unilateral cleft lip (common): due to failure of the maxillary process on one side to fuse with the globular process.
- Bilateral cleft lip (rare): due to failure of both maxillary processes to fuse with the globular process.
- Median cleft lip (very rare): due to failure of the two median nasal processes to merge into the globular process.
- Microstomia (small lip opening): excessive fusion of the maxillary and mandibular processes in the region of the angle of the mouth.
- Macrostomia (large lip opening): incomplete fusion of maxillary and mandibular processes.

- Median mandibular cleft (rare): persistence of the cleft between right and left mandibular processes. The 'dimpled' chin probably represents a very mild form.

2. Palate abnormalities arise from the failure in the synchronization of growth of the nasal septum, primitive palate, palatal shelves and tongue. Lowering of the tongue allows normal fusion of the developmental process.
   Failure of fusion results in:

   - Bifid uvula: this is a mild form of soft palate clefting that usually causes no functional problems.
   - Unilateral cleft palate: due to failure of one palatal shelf to fuse with the nasal septum and the other palatal shelf.
   - Bilateral cleft palate: due to failure of both palatal shelves to fuse with the nasal septum and each other.

   Increasingly severe clefting of the palate progresses from posterior to anterior. The most severe clefts include the alveolar process and the lip. However, clefting of the palate and lip are independently determined and each may occur in isolation from the other.

Bilateral Cleft Lip and Palate

A bilateral cleft lip and palate can thus be complete or incomplete on one or both sides. The isolated premaxilla can vary greatly in development, size, shape and position (Berkowitz, 1996). The cleft lip and palate malformation is the most frequently occurring oro-facial deformity. The incidence of oro-facial clefting seems to increase. Several factors may be responsible for this, such as decreased neonatal mortality, environmental factors (drug and pollution), increased frequency of intermarriage and childbirth in parents with clefts as a

result of better social acceptability. Also, an improved registration may play an important role (Heidbüchel, 1997).

The differences in dento-facial appearance between persons with or without a cleft can be the result of several factors. Firstly, there maybe exists a substantially different morphogenetics pattern, which is part of an overall cleft syndrome. Secondly, there could be adaptive changes due to the mechanical presence of the cleft or lack of continuity of the tissues. Thirdly, surgical and orthodontic treatment and wound healing influence also (further) dento-facial development. Besides clinical studies and animal experimental research, the study of unoperated persons with BCLP can give more information of the impact about each of those factors.

At birth, the isolated premaxilla in BCLP is displaced anteriorly in relation to the antero-inferior border of the nasal septum. Because premaxilla is under no restraint laterally from either bone or gingival fibrous tissue, it is, on the other hand, assumed that its attachment to the nasal septum by the septo-premaxillary ligament becomes a dominant factor. This results in various degrees of premaxillary protrusion and abnormal vertical position and also underdevelopment of the lateral maxillary segments (Heidbüchel, 1997). The intertuberosity distance is mostly increased. The hard and soft palates are open. Consequently, the velopharyngeal muscles (tensor and levator veli palatini, palatopharyngeus, palatoglossus and constrictor superior) do not meet each other. This results in palatopharyngeal incompetence, which influences speech and hearing.

In unoperated adults, an underdevelopment of the columella and prolabium is still observed. The premaxilla is still protruded and mostly rotated. The anterior ends of the lateral segments show a medial collapse or a lateral external displacement. However the posterior segments at the level of the molars are in normal position and relationship to the mandible. There is a tendency for the mandibular plane to be steep, which may be attributed to the presence of a palatal cleft. The maxillary central incisors are often rotated or normally

angulated labiolingually within the protrusive premaxilla. Other dental abnormalities such as supernumerary teeth, absent teeth and teeth malformation are frequently observed. As the hard and soft palate are not operated, this has its negative consequences for speech and hearing. When compared with an operated group, the unoperated group shows a larger cleft and nasal width.

Maxillary Arch Dimensions

Intertuberosity width or Inter Maxillary Tuberosity Distance (IMTD) is the maxillary posterior arch width. Desai *et al.* (1997) found that the average IMTD in English population was 28 mm in both children with cleft deformity and in noncleft children from birth to six years of age. The average IMTD in English adult was 35 mm. So in the newborn the bony width of the maxillae is 4/5 of the adult. In crude terms, the orthodontist has to move each maxilla only 3.5 mm each side if there was no collapse of the maxilla in the first place. The IMTD is about 32 mm in mixed dentition.

Heidbüchel (1997) in the study of maxillary arch dimensions in Bilateral Cleft Lip and Plate (BCLP) boys from birth until 4 years of age at the Cleft Palate Center of the University Hospital of Nijmegen (Holland), found that at birth, babies with bilateral cleft lip and palate demonstrated significantly greater maxillary arch widths (intercanine width) compared to non-cleft individuals. From six to 18 months, the intercanine width reduced markedly in BCLP children, while Intertuberosity width showed stabilization. Heidbüchel (1997) also stated that during the first four year of life maxillary arch development in children with a complete bilateral cleft never shows a growth curve comparable to non-cleft children. At birth most maxillary arche distances are larger in BLCP than in non-cleft children. At the four years of age the opposite is true for many of the dimensions.

Cleft Treatment

Treatment priorities for most surgeons when to close the palatal cleft include intelligible speech first followed by normal palatal and facial development and dental occlusion. In some instances, such a priority system has justified poor reconstructive surgery that has created midfacial deformities with the excuse that the patient can at least speak well. Sufficient evidence is now available to support the views that good palatal and facial development, dental occlusion and intelligible speech are not mutually exclusive (Berkowitz, 1990).

The unsettling experience of performing the same surgical procedure on similar cleft types with different and often growth-inhibiting consequences has led to futile attempts to develop new and untested techniques. The history of cleft palate surgery is replete with such hit-or-miss approaches to find a surgical solution to very complex biologic problems. However, it has been only in the last 40 years since the introduction of cephalometric roentgenography and the collection of serial dental casts begun to focus on examination of the developing affected face and palate to explain relationships that might exist between palatal surgery and facial development (Berkowitz, 1990). The success of treatment depended on many factors over which the surgeon had little or no control and that surgical solution based on individual or race treatment plan rather than fitting each treatment to a fixed textbook formula. Only few studies compare cleft patients of different races. In this area, further investigations would certainly provide more information (Lambrecht *et al.* 2000).

The nature of the distortion and derangement of the skeletal components seen at birth and the effects of surgery and growth on the palatal segments have been studied only in part. This deficiency in our understanding of palatal development, which is essential to further refine and improve rehabilitative procedures, is due to the lack of an appropriate measuring devices. The rapid advances in technology have created many new possibilities in analyzing

metrically the measurement of cleft palate in plaster casts jaw model. In this study, a series of a Standard and Digital Sliding caliper have been used to analyze metrically of the cleft lip/palate and dental arch measurement.

Following the standards of the American Cleft Palate-Craniofacial Association, the cleft palate team should minimally have an operating surgeon, an orthodontist and a speech-language pathologist. Additionally regular contacts should exist with specialists from otolaryngology, audiology, paediatrics, genetics, social worker, psychology and prosthetic dentistry.

Feeding of a BCLP baby can cause special problems. The hard palate is part of the sucking mechanism and in case of a cleft sucking activity may be difficult to achieve. At a later age, in children with BCLP mastication can be disturbed due to an incorrect position of the teeth and/or bad jaw relation. Later on speech and hearing problems can arise; BCLP patients showed poorer speech and neede more speech therapy than the unilateral ones.

The objective of the orthodontics therapy in children with BCLP is to align the dento-alveolar and jaw structures to their optimum form and relationships in order to achieve the best possible oral function and aesthetics. Success of orthodontics treatment is largely dependent on the antecedent surgical procedures, on the nature of the cleft and on the patient's phenotype. Orthodontic tretment planning depends often on the stage of dental development. Knowledge of dental development is important in order to predict start and/or duration of the orthodontics treatment. However, only few information exist about dental age in BCLP which is in addition inconsistent.

Objective

The aim of this investigation is:

- To compare maxillary arch development of BCLP Kelantan Malay children with a BCLP Caucasian children during the first four years of life.
- To give a detailed description of maxillary arch development in Kelantan Malay children with a Bilateral Cleft Lip and Plate (BCLP)

Material and Methods

This was a restrospective study. Samples used in this study consist of seventy six non operated complete bilateral cleft lip and palate (BCLP) children , who were born between 1986 to 2000 and their dental casts were collected from Kota Bharu Hospital and USM Hospital. They were all of Malaysian Malay origin and had no other congenital anomaly other than oral cleft.

The data of Caucasian BCLP patient were collected from dental casts at the University Hospital of Nijmegen, Holland: PhD Degree Dissertation in Medical Science of the University of Nijmegen, Netherland (Heidbüchel, K.L.W.M. *et al.*, 1997). Twenty six children with complete bilateral cleft lip and palate were studied. They were born between 1976 and 1990. They were all of Caucasian Dutch origin and had no other congenital anomaly than oral cleft.

The criteria of the samples were :

1. Inclusion Criteria:
   - CLP without other congenital abnormality
   - Patient is Malaysian Malays

2. Exclusion Criteria:
   - CLP with other congenital abnormality
   - Present of soft tissue bridges

Dental impressions were taken from all samples and dental casts were made and the points were determined. Maxillary arch dimensions were calculated twice on the dental casts by using Digital Sliding Caliper (Fowler Ultra-Gold, USA) as shown in Fig. 2. Digital sliding caliper can be connected to the computer by using Fowler digital connector and special data software. Measurement data were transfered to the computer and can be read on the monitor.

Measurement of the anatomical and constructed points is determined according to Sillman (1964) and Robertson *et.al.* (1977) as describe in following picture (Fig. 1):

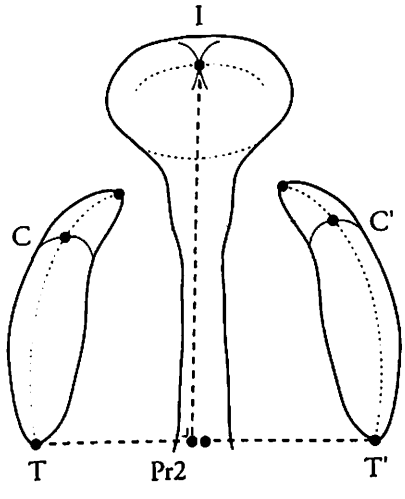

Fig. 1: Points digitized on dental casts

Points digitized on dental casts :

- Point I (Incisal point) : point on the top of the alveolar crest where the incisive papilla and labial frenulum meet, or the tip of the interdental papilla between the central incisor.
- Point C (Cuspid point) : where the lateral sulcus crosses the crest of the alveolar ridge, or the distal anatomical contact point of the deciduous canine.
- Point T (Tuberosity point) : the posterior limit of the tuber maxillare in the sulcus where the raphe pterygo-mandibularis adheres, or the distal point of the second deciduous molar.
- Point Pr2 : projection of point I on the line T-T' : This points constructed by the computer out of the digitized points.

Calculated distances :

- C-C' : intercanine width or, maxillary anterior arch width
- T-T' : intertuberosity width or maxillary posterior arch width
- I-Pr2 : total arch depth

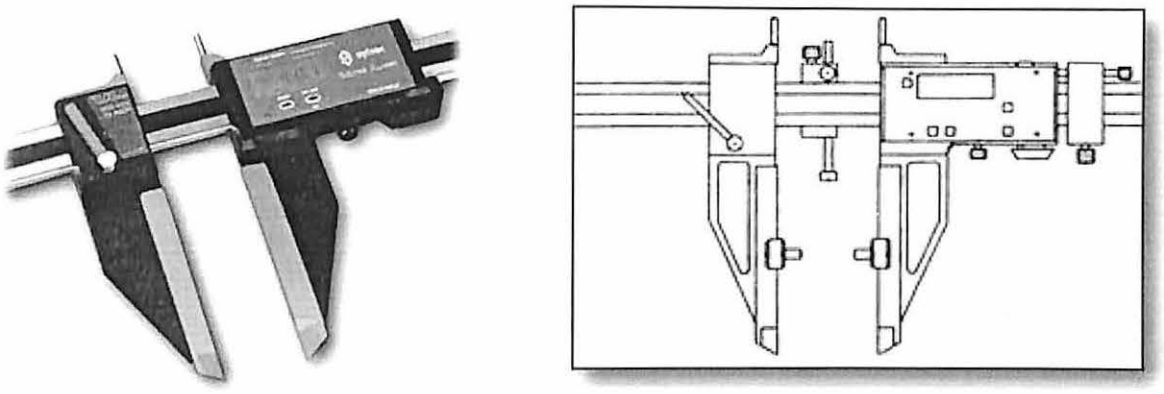

Fig. 2: Fowler Sliding Caliper

Maxillary arch dimensions, were calculated from the coordinates and were converted into 12 different ages by interpolating data (ie.: 0, 1, 3, 6, 9, 12, 18, 24, 30, 36, 42 and 48 months. The distance of the interpolated value to the nearest age period was not allowed to be more than two weeks in the first year of life and six weeks thereafter. Extrapolation was not applied.

In order to determine the measurement error from Kelantan control group, 76 dental casts, covering the full range of ages were randomly selected and digitized by same person similar to the method done to the Nijmegen group.

To identify the differences betwen the BLCP Kelantan group and the BLCP Nijmegen group at the different ages, the Mann Whitney test and Student t-test was applied.

Results

Measurement errors of the Nijmegen BLCP group ranged from 0.3 to 0.5 mm and were showed in Table 1.

Table 1. *Measurement error on Nijmegen BCLP Group*

Measurement	Observer Measurement Error
Anterior arch width (C-C′)	0.26 mm
Posterior arch width (T-T′)	0.53 mm
Total arch depth (I-Pr2)	0.32 mm

Measurement errors of the Kelantan BCLP group ranged from 0.3 to 0.5 mm and were showed in Table 2.

Table 2. *Measurement error on Kelantan BCLP Group*

Measurement	Observer Measurement Error
Anterior arch width (C-C′)	0.28 mm
Posterior arch width (T-T′)	0.46 mm
Total arch depth (I-Pr2)	0.33 mm

1. Intercanine width (C-C′)

Intercanine width (C-C′) measurements between Nijmegen BCLP group and Kelantan BCLP group is shown on Table 3.

Table 3. *Intercanine Width*

	Nijmegen Group		Kelantan Group	
Age	*n*	*Median*	*n*	*Median*
Less than 1 month	20	30.4	4	28.3
1	23	30.6	6	28.8
3	26	30.9	7	29.2
6	26	32.0	9	29.9
9	25	31.0	8	29.2
12	25	29.6	9	29.4
18	22	27.3	6	27.1
24	21	27.7	6	27.6
30	21	27.1	6	26.7
36	21	27.1	6	26.8
42	19	27.0	5	26.7
48	18	27.1	4	26.9

Table 4. *Intercanine width comparison between Nijmegen BCLP Group and Kelantan BCLP Group in 0 to 48 months using t-test.*

Paired Differences					t	df	Sig. (2-tailed)
Mean	Std. Deviation	Std. Error	95% Confidence Interval of the Difference				
			Lower	Upper			
0.9500	0.7586	0.2190	0.4680	1.4320	4.338	11	0.001*

* Significant

Table 3. *Intercanine Width*

	Nijmegen Group		Ke
Age	*n*	*Median*	*n*
Less than 1 month	20	30.4	4
1	23	30.6	6
3	26	30.9	7
6	26	32.0	9
9	25	31.0	8
12	25	29.6	9
18	22	27.3	6
24	21	27.7	6
30	21	27.1	6
36	21	27.1	6
42	19	27.0	5
48	18	27.1	4

Table 4. *Intercanine width comparison between Nij*
Kelantan BCLP Group in 0 to 48 months us

Paired Differences				
Mean	Std. Deviation	Std. Error	95% Confidence Interval of the Difference	
			Lower	Upper
0.9500	0.7586	0.2190	0.4680	1.4320

Table 5. *Intercanine width comparison between Nijmegen BCLP Group and Kelantan BCLP Group in 0 to 12 months using t-test.*

Paired Differences					t	df	Sig. (2-tailed)
Mean	Std. Deviation	Std. Error	95% Confidence Interval of the Difference				
			Lower	Upper			
1.6500	0.2345	9.5740	1.4039	1.8961	17.234	5	0.001*

* Significant

Table 6. *Intercanine width comparison between Nijmegen BCLP Group and Kelantan BCLP Group in 18 to 48 months using t-test.*

Paired Differences					t	df	Sig. (2-tailed)
Mean	Std. Deviation	Std. Error	95% Confidence Interval of the Difference				
			Lower	Upper			
0.2500	0.1871	7.6380	5.3670	0.4463	3.273	5	0.022*

* Not significant

Intercanine width (C-C') was significantly larger in the Nijmegen BCLP group than in Kelantan BCLP group during the first 12 months of age. (Table 5). Thereafter the difference decreased and is not significant until the age of 48 months. This result is shown graphically in Figure 3 below to illustrate the maxillary arch dimensions more clearly (Fig. 3)

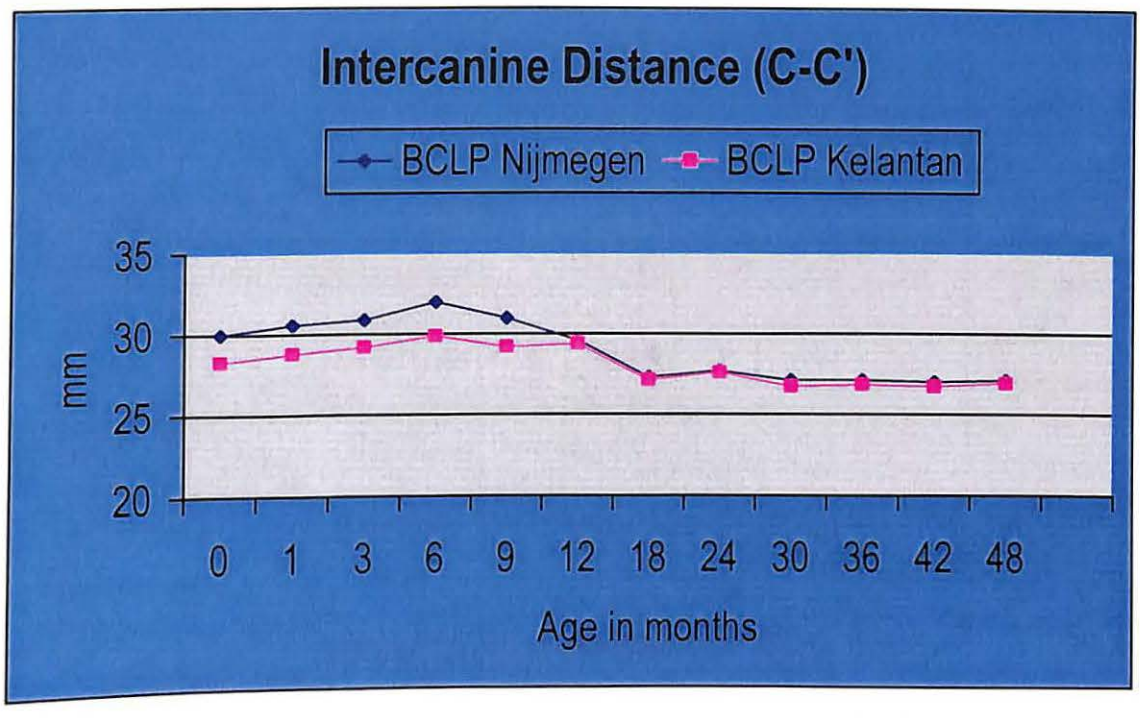

Fig. 3: Intercanine differences between Nijmegen BCLP group and Kelantan BCLP group

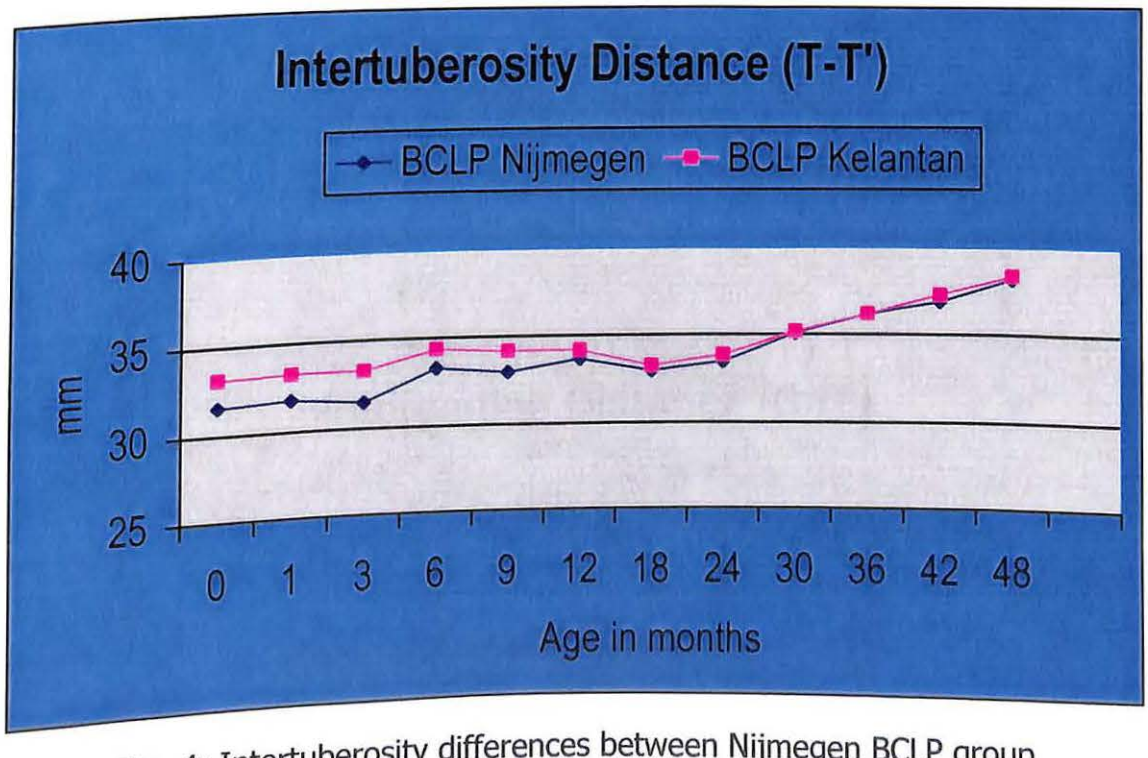

Fig. 4: Intertuberosity differences between Nijmegen BCLP group and Kelantan BCLP group

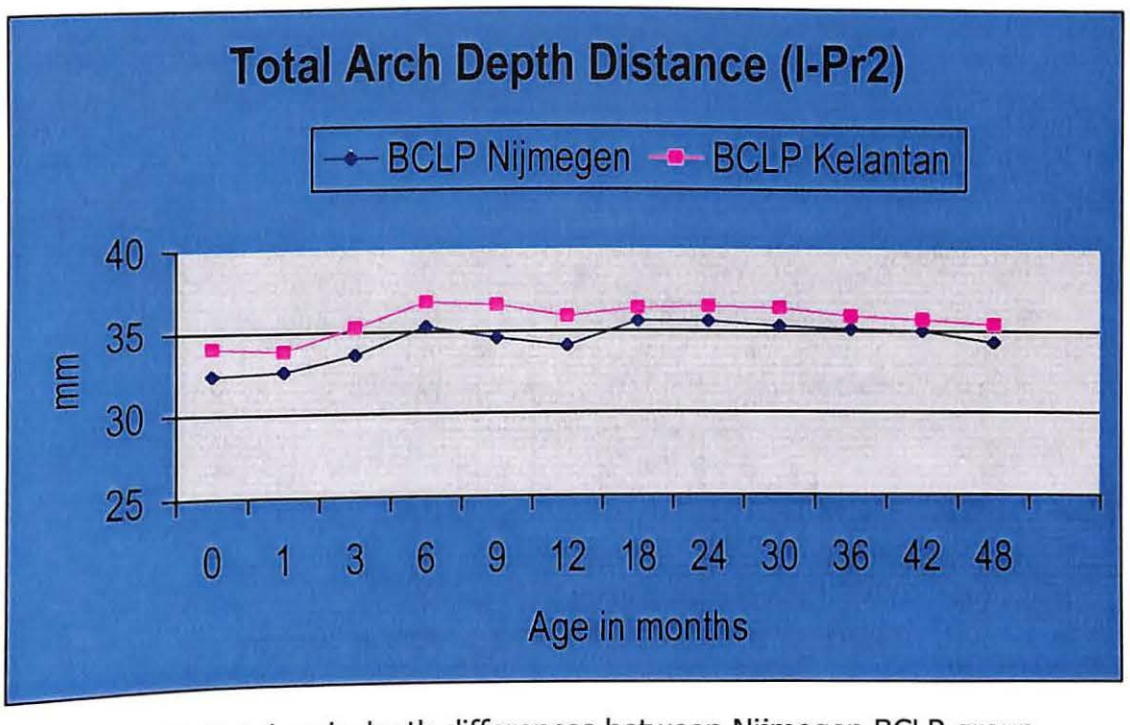

Fig. 5: Total arch depth differences between Nijmegen BCLP group and Kelantan BCLP group

2. Intertuberosity width (T-T)

Intertuberosity width (T-T') measurements between Nijmegen BCLP group and Kelantan BCLP group showed on Table 7.

Table 7. *InterTuberosity Width*

	Nijmegen Group		Kelantan Group	
Age	*n*	*Median*	*n*	*Median*
Less than 1 month	20	31.6	4	33.2
1	23	31.8	6	33.3
3	26	31.5	7	33.3
6	26	33.3	9	34.4
9	25	33.0	8	34.2
12	25	33.7	9	34.2
18	22	33.0	6	33.3
24	21	33.5	6	33.9
30	21	35.1	6	35.2
36	21	36.2	6	36.4
42	19	36.9	5	37.2
48	18	38.2	4	38.3

Intertuberosity width (T-T') on the other hand was significantly larger in the Kelantan BCLP group than in Nijmegen BCLP group during the first 12 months (Table 9). Thereafter the differences decreased and is not significant until the age of 48 months. This result shown graphically in Figure 4.

Table 8. *Intertuberosity width comparison between Nijmegen BCLP Group and Kelantan BCLP Group in 0 to 48 months using t-test.*

Paired Differences					t	df	Sig. (2-tailed)
Mean	Std. Deviation	Std. Error	95% Confidence Interval of the Difference				
			Lower	Upper			
-0.7583	0.4907	0.1417	-1.0701	-0.4465	-5.353	11	0.001*

* Significant

Table 9. *Intertuberosity width comparison between Nijmegen BCLP Group and Kelantan BCLP Group in 0 to 12 months using t-test.*

Paired Differences					t	df	Sig. (2-tailed)
Mean	Std. Deviation	Std. Error	95% Confidence Interval of the Difference				
			Lower	Upper			
-0.9500	0.5010	0.2045	-1.4758	-0.4242	-4.645	5	0.006*

* Significant

Table 10. *Intertuberosity width comparison between Nijmegen BCLP Group and Kelantan BCLP Group in 18 to 48 months using t-test.*

Paired Differences					t	df	Sig. (2-tailed)
Mean	Std. Deviation	Std. Error	95% Confidence Interval of the Difference				
			Lower	Upper			
-0.5667	0.4367	0.1783	-1.0249	-0.1084	-3.179	5	0.025*

* Not Significant

3. Total Arch Depth (I-Pr2)

Total arch depth (I-Pr2) measurements between Nijmegen BCLP group and Kelantan BCLP group showed on Table 11.

Table 11. *Total Arch Depth*

	Nijmegen Group		Kelantan Group	
Age	*n*	*Median*	*n*	*Median*
Less than 1 month	20	32.4	4	34.1
1	23	32.6	6	33.9
3	26	33.6	7	35.3
6	26	35.3	9	36.8
9	25	34.6	8	36.6
12	25	34.1	9	35.9
18	22	35.6	6	36.4
24	21	35.6	6	36.5
30	21	35.3	6	36.4
36	21	35.1	6	35.9
42	19	35.0	5	35.7
48	18	34.3	4	35.4

Total arch depth (I-Pr2) was significantly larger in the Kelantan BCLP group than in Nijmegen BCLP group at the first 12 months (Table 13). Thereafter the differences were decrease and not significant until the age of 48 months. This result is shown graphically in Figure 5.

Table 12. *Total arch depth comparison between Nijmegen BCLP Group and Kelantan BCLP Group in 0 to 48 months using t-test.*

Paired Differences					t	df	Sig. (2-tailed)
Mean	Std. Deviation	Std. Error	95% Confidence Interval of the Difference				
			Lower	Upper			
-1.2833	0.4469	0.1290	-1.5673	-0.9994	-9.948	11	0.001*

* Significant

Table 13. *Total arch depth comparison between Nijmegen BCLP Group and Kelantan BCLP Group in 0 to 12 months using t-test.*

Paired Differences					t	df	Sig. (2-tailed)
Mean	Std. Deviation	Std. Error	95% Confidence Interval of the Difference				
			Lower	Upper			
-1.6667	0.2422	9.8880	-1.9209	-1.9209	-16.855	5	0.001*

* Significant

Table 14. *Total arch depth comparison between Nijmegen BCLP Group and Kelantan BCLP Group in 18 to 48 months using t-test.*

Paired Differences					t	df	Sig. (2-tailed)
Mean	Std. Deviation	Std. Error	95% Confidence Interval of the Difference				
			Lower	Upper			
-0.9000	0.1673	6.8310	-1.0756	-0.7244	-13.175	5	0.001*

* Significant

Discussion

In this study maxillary arch dimensions were studied in Kelantan BCLP group and compared to the same arch dimensions study in Nijmegen BCLP children. Intercanine width and intertuberosity width were digitized and measured by using digital sliding caliper. Measurement errors ranged from 0.3 to 0.5 mm for distance, which is considered to be acceptable (Seckel *et al.*, 1995).

Adolf Schwartz (1961) published data of normal newborn maxillae of 52 cm body length. He reported a 7 mm wide range of the inter-tuberosity width (33 to 40 mm), which is more than 20% of the mean. A similar wide range of the variations of width and shape of newborn maxillae has been reported by Hotz and Gnoinski (1979) on plaster models provided by Prof. Leighton of King's College Hospital, London. All of these investigations using calliper measurements.

At birth, babies with BCLP demonstrated significantly greater maxillary arch widths compared to non-cleft babies. Anterior and total arch depths were also significantly larger than in non-cleft. From six to 18 months the intercanine reduced markedly. This points to an anterior collapse of the lateral alveolar segments in BCLP children, while intertuberosity width showed a stabilization. From 12 months of age and thereafter, arch depths showed a slight catch-up growth, while the intertuberosity width showed hardly any growth until 24 months (Heidbüchel, 1997).

Herman (2000) in the study of Craniofacial Morphology and Growth in Infant and Young Children with Cleft Lip and Palate found that at 2 months of age a general increase width of the maxillary dental arch of the Cleft Lip and Palate children, that can be related to the increased width of the maxilla. Since the primary teeth had not yet erupted and crown formation is not completed, the teeth can be assumed to be relatively stable in position within the bone.

Otto Kriens (1989) in the investigations of Model Analysis of Cleft Lip and Palate found that the mean value of the intertuberosity distance (PP1) in 38