ABSTRACT

ANTHROPOMETRIC MEASUREMENT OF THE LIP-NOSE COMPLEX AMONG YOUNG ADULTS IN KUALA LUMPUR, MALAYSIA

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Introduction: The lip-nose complex is an important aesthetic subunit of the mid and lower face. To date, there is no published data on lip-nose complex anthropometry for the Malaysian population.

Objectives: This cross sectional descriptive study aims to establish the norms of the lip-nose complex among Malaysian Malays, Chinese and Indians and to compare the transgender and transethnic variation between them.

Materials and Method: Seven parameters of the lip-nose complex namely mouth width, cupids bow width, columellar width, nasal width, lip height, columellar height and dome height were measured using standard anthropometric measurement tools. Three hundred sixteen-year-

olds were randomly selected from three schools in Kuala Lumpur, with equal gender and ethnic distribution.

Results: All seven parameters the lip-nose complex in Malay, Chinese and Indian males were consistently larger than their respective female counterparts ($p<0.05$). The difference in lip-nose complex measurements for mouth width, nasal width, lip height and dome height were statistically different between Malays, Chinese and Indians. Mouth width and nasal width were widest among Malays. Lip height was highest amongst Indians. Dome height was highest amongst the Chinese. The cupids bow distance, columellar width and height showed minimal difference within the three races ($p>0.05$). Malays and Chinese differed in all parameters except cupids bow width. Malays and Indians only differed in mouth width and nasal width. Chinese and Indians differed in lip height and dome height.

Conclusion: Malays and Chinese show differences in their lip-nose complex profile despite having originated from the East Asian continent. Malays and Indians differed in width measures, while the Chinese and Indians differed in height measures. The variation of anthropological measurements among the three ethnic groups reinforces the need to have individualized norms. These findings form a baseline for future studies that are age based which would then serve as an invaluable guide to the reconstructive surgeon especially when dealing with unilateral and bilateral cleft lip repairs.

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by

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PREFACE

The lip-nose complex occupies the middle and lower face region. The unique properties of this region especially the cupids bow area is unique and difficult to reproduce. Therefore any abnormality or asymmetry in this region is easily noticeable. Surgeons frequently work in this region for improving the aesthetic appearance of the lip and nose profile. This is also the region of focus in cleft lip patients during cheiloplasty and nasal repair.

Anthropometric norms are average measurements of specific regions obtained from healthy individuals of a specific group. These serve as a guide to the operating surgeon when doing both aesthetic as well as reconstructive surgeries. Facial proportions differ between one ethnic group and the other. The anthropometric norms of the North American whites have been extensively researched and published. These form the current guide for aesthetic and reconstructive surgeons in our country. There is no complete database for the lip-nose complex of the multiethnic population of Malaysia that has been published to date.

Knowing the need for the establishment of an anthropometric database among the Malaysian population, we conducted measurements on Malay, Chinese and Indian young adults from Kuala Lumpur, the capital state of Malaysia to produce our very own anthropometric database.

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ABSTRAK (BAHASA MALAYSIA)

Kompleks bibir-hidung adalah subunit estetik bahagian tengah dan bawah muka yang penting. Sehingga kini, tiada data yang dicetak mengenai anthropometri kompleks bibir-hidung bagi populasi Malaysia. Kajian perihal secara 'cross sectional' bertujuan menyediakan norma kompleks bibir-hidung di antara kaum Melayu, Cina dan India di Malaysia dan mengetahui perbezaan antara jantina dan kaum etnik.

Tujuh kawasan kompleks bibir-hidung iaitu kelebaran mulut, kelebaran 'cupids bow' kelebaran columellar, kelebaran hidung, ketinggian bibir, ketinggian columellar and ketinggian kubah hidung diukur dengan menggunakan peralatan pengukuran anthropometric yang berpatutan. Tiga ratus individu berumur enam belas tahun dipilih secara rawak dari tiga buah sekolah di Kuala Lumpur, dengan pembahagian jantina dan kaum etnik yang sama banyak.

Keputusan yang didapati menunjukan bahawa ketujuh-tujuh parameter kompleks bibir-hidung di antara lelaki dari kaum Melayu, Cina dan India adalah lebih besar dari subjek wanita dalam kategori yang sama ($p<0.05$). Perbezaan antara kelebaran mulut, kelebaran hidung dan ketinggian kubah hidung adalah ketara secara statistik di antara kaum Melayu, Cina dan India. Kelebaran mulut adalah paling tinggi di antara kaum Melayu. Kelebaran mulut dan hidung adalah paling tinggi di kalangan orang Melayu. Ketinggian bibir adalah tertinggi di kalangan orang India. Ketinggian kubah hidung adalah tertinggi si antara kaum Cina. Jarak 'cupids bow', kelebaran columellar dan ketinggian columellar menunjukkan perbezaan yang minima di antara ketiga-tiga kaum ($p>0.05$). Kaum Melayu dan Cina berbeza dalam semua parameter kecuali kelebaran 'cupids bow'. Kaum Melayu dan India hanya berbeza dalam ukuran kelebaran mulut dan hidung. Kaum Cina dan India berbeza dalam ukuran ketinggian bibir dan kubah hidung.

Kaum Melayu dan Cina menunjukkan perbezaan antara profil kompleks bibir-hidung walaupun keduanya berasal dari benua Asia Timur. Kaum Melayu dan India berbeza dalam pengukuran kelebaran manakala Kaum Cina dan India berbeza dalam pengukuran ketinggian. Ketidaksamaan dalam pengukuran antropometrik di antara tiga kumpulan ethnic menunjukan bahawa kita perlu mengasakan norma yang berindividu. Keputusan yang diperolehi akan menjadi asas bagi kajian-kajian seterusnya yang berdasarkan umur yang berpotensi membantu pakar bedah rekonstruktif apabila merawat pesakit rekahan mulut dan bibir sama ada yang sebelah atau dua belah.

ABSTRACT (ENGLISH)

The lip-nose complex is an important aesthetic subunit of the mid and lower face. To date, there is no published data on lip-nose complex anthropometry for the Malaysian population. This cross sectional descriptive study aims to establish the norms of the lip-nose complex among Malaysian Malays, Chinese and Indians and to compare the transgender and transethnic variation between them.

Seven parameters of the lip-nose complex namely mouth width, cupids bow width, columellar width, nasal width, lip height, columellar height and dome height were measured using standard anthropometric measurement tools. Three hundred sixteen-year-olds were randomly selected from three schools in Kuala Lumpur, with equal gender and ethnic distribution.

Results obtained showed that all seven parameters the lip-nose complex in Malay, Chinese and Indian males were consistently larger than their respective female counterparts ($p<0.05$). The difference in lip-nose complex measurements for mouth width, nasal width, lip height and dome height were statistically different between Malays, Chinese and Indians. Mouth width and nasal width were widest among Malays. Lip height was highest amongst Indians. Dome height was highest amongst the Chinese. The cupids bow distance, columellar width and height showed minimal difference within the three races ($p>0.05$). Malays and Chinese differed in all parameters except cupids bow width. Malays and Indians only differed in mouth width and nasal width. Chinese and Indians differed in lip height and dome height.

Malays and Chinese show differences in their lip-nose complex profile despite having originated from the East Asian continent. Malays and Indians differed in width measures, while the Chinese and Indians differed in height measures. The variation of anthropological measurements among

the three ethnic groups reinforces the need to have individualized norms. These findings form a baseline for future studies that are age based which would then serve as an invaluable guide to the reconstructive surgeon especially when dealing with unilateral and bilateral cleft lip repairs.

1.0 INTRODUCTION AND LITERATURE REVIEW

1.1 Research Background

Facial analysis is the preliminary step in the assessment of patients who present for aesthetic or reconstructive procedures of the face. It helps to determine the goals and desired outcomes of the proposed surgical procedure. Anthropometric studies of the face and neck serve as a guide to the average measurements in specific regions. The majority of literature for anthropometric face and neck assessment available currently is based on the measurements of North American white women (Farkas, 1994, Farkas et al., 1985). However, no two faces are alike. Many studies have shown considerable differences between facial proportions among people of various ethnic descents (Choe et al., 2004, Farkas et al., 2007, Heidari et al., 2009, Husein et al., 2009, Porter, 2004.)

Surgeons require access to craniofacial databases based on accurate anthropometric measurements to successfully treat congenital or post-traumatic facial disfigurements. This is especially so when dealing with patients from various ethnic groups (Farkas et al., 2005). It has been stated that there are inherent anatomic differences between Asians and whites that may mislead a surgeon who is accustomed to operative techniques for only one of the races (Dhong et al., 2002).

Farkas et. al. (2005) conducted an extensive study on facial morphology among the various ethnic groups/races from Europe, the Middle-East, Asia and Africa. Asian countries included in this study are India, Japan, the Chinese of Singapore, Vietnam and Thailand. Some local studies

have also been done to generate their own database. One study was conducted on the KadazanDusun population while another was done on Malaysian Indians (Akan et al., 2005, Ngeow & Aljunid, 2009). However, no anthropometric study has been done on the lip-nose complex among the local population.

The lip-nose complex is an important aesthetic subunit of the mid and lower face which is also the area involved in cleft lip surgery. This is a study of the lip-nose complex parameters and aims to obtain a baseline of the norms in this region amongst the three main ethnic populations in Malaysia.

1.2 The Malaysian population

In 2010, Malaysia has a population of 28.25 million. Of these, 27.2% are children <15 years of age, 68.1% are between 15 to 64 years and 4.7 are senior citizens >65years (Statistics Dept., 2010).

Malaysia is a multiethnic society with people of Malay, Chinese, Indian, Kadazan, Iban and other various ethnicities. Of these, 65% are Malays, 26% are Chinese 8% are Indians and 2% are from other ethnic backgrounds (Population Statistics, 2004). Each of these ethnic groups have diverse facial proportions. The aesthetic appearances that are valued in various cultures are also different. Understanding both the overt and covert differences in our multicultural society will help in delivering optimum aesthetic and reconstructive services in our country.

There is a rise in the number of people seeking aesthetic procedures in our country evidenced by the boom in the local beauty and cosmetic scene. Most of the reference points that patients have are those of whites. Even Asian references from Japanese, Singaporean Chinese, Vietnamese and Thai populations differ from one another (Farkas et al., 2005). On the reconstructive side, we have a large number of patients born with unilateral or bilateral cleft lip and palate as well as various other congenital anomalies. It is useful to have a baseline measurement of the specific ethnic population especially when reconstructing bilateral defects.

Creating a representative population sample for anthropometric evaluation is much easier in countries with a predominant ethnic group than in countries with multi-ethnic population (Farkas, 1996). According to Farkas, in order to generate accurate anthropometric normative data in a multi-ethnic population, investigators must ensure that individual ethnic groups are properly identified and the major groups represented in the study sample are in the same proportion as in the general population (Farkas, 1996).

There are a small number of studies done on our local population. Akan et al. (2005), studied five linear horizontal measurements in 140 KadazanDusun adults, comparing them to the neoclassical facial canons. They found that the facial proportions of the KadazanDusun did not follow the neoclassical facial canons and that the nose of the KadazanDusun is proportionally larger in relationship to structures like the interorbital area, the mouth and the face.

Ngeow and Aljunid (2009) established the craniofacial anthropometric norms of 100 young Malaysian Indian adults by measuring 22 parameters. It was found that Malaysian Indians do exhibit some North American white Caucasian features.

There is no published data on anthropometric measurement of the lip-nose complex in the Malaysian population. Therefore this study will provide a baseline data on the lip-nose complex measurements of 16 year old Malaysian Malays, Chinese and Indians .

1.3 Anthropometry

Anthropometry (from the Greek anthropos, “human” and metron, “measure”) is the biological science of measuring the size, weight, and proportions of the human body (Farkas, 1994). By tradition, anthropometry has been carried out by taking measurements from body surface landmarks, such as circumference, length and breadth, using simple instruments (Uzun et al., 2006). Anthropometry is the objective analysis that replaces subjective visual judgement (anthroposcopy) with quantitative measurement (Farkas et al., 1992). Anthropometric measurement can be used for quantifying craniofacial dysmorphology, for surgical planning and outcome assessment (Wong et al., 2008).

Facial anthropometric analysis is a technique that yields accurate soft tissue measurements of the face. It has been used to define soft tissue relationships and standards for the purposes of objective facial analysis. The dimensions of facial soft tissue structures (nose, lips and chin), their reciprocal spatial positions and their relative proportions are important components in the clinical analysis of orthodontic, maxillofacial and plastic surgery patients (Mack, 1991;

Lundstrom et al., 1992; Skinazi et al., 1994; Ferrario and Sforza, 1997). Normative data of facial measurements are indispensible for precise determination of the degree of deviation from the normal (Farkas et al., 2005).

But how accurate should the anthropometric measurement be? The father of medical anthropometry, Dr Aleš Hrdlička (1920) named three basic requirements for accuracy. The first is the examiner's skill, the second is the ability to locate the craniofacial landmarks and the last is to have available a set of high-quality measuring tools. Farkas et al. (1986), added a fourth contributing factor - the cooperation of the examinee during the procedure. Skill of measurement is said to depend more on the number of subjects examined per year than on years of doing the measurement. Dr Hrdlička also stated that "our instruments will never be so accurate or senses so precise, and our subjects or specimens will never offer such forms, that an absolute precision may be obtained." According to Goldstein (1936), "in biological research, especially with reference to observation in anatomy, extreme precision is actually not necessary." However, this does not hold true for measurements of the lip-nose complex. Even a difference of 0.5mm in the region of the white roll is visibly evident. Therefore, we should conduct anthropometric studies with the highest possible accuracy as the data obtained will be used as normative data.

Leslie G. Farkas, a plastic and reconstructive surgeon is considered the modern father of soft-tissue facial anthropometry, having published more than 120 scientific articles (Bashour, 2006). He has defined almost every single imaginable facial measurement and index ratio on the human face and is the most highly cited author in the field. He has shown that anthropometry has a role in evaluation and surgical treatment of numerous congenital craniofacial disorders and in general

facial plastic and cosmetic surgery. He has had anthropological studies conducted amongst the international community (Farkas et al., 2005) and has also revised the neoclassical canons.

Several new technologies have been designed to computerize anthropometric measurements, including three-dimensional (3D) digital photogrammetry (Wong et al., 2008). These digital systems have the advantage of acquiring craniofacial surface images quickly and noninvasively. Wong et al., 2008 compared 3D digital photogrammetric measurements of 18 facial linear distances with direct measurement and found that all but one direct measurement correlated highly with the digital measurement. A somewhat similar study by Weinberg et al. in 2006 rendered similar outcomes.

Aung et al. (1995) measured facial anthropometry using an optical surface scanner which uses a laser stripe triangulation to rapidly and accurately digitize object surfaces. When compared to direct anthropometric measurements, the most highly reliable area for measurement with this modality was centered around the nose, circumoral and orbital areas.

Mishima et al. in 2002 developed a three-dimensional measuring system for measuring the nasal shape of 129 Japanese subjects. He proposed a new system of evaluating the nasal shape by regarding the nose as a polyhedron made up of triangles. Using this method, he evaluated the outcome following rhinoplasty in cleft lip patients.

Apart from anthropometry, other modalities for quantifying facial morphology include radiographic cephalometry (Budai et al.,2003 and Farkas et al.,1999) However, studies done to

compare anthropometric and cephalometric examination showed that discrepancies existed between these two measurement modalities (Budai et al.,2003 and Farkas et al.,1999) and therefore the morphological changes of the face should be judged separately on the surface and on the skeleton of the patient (Budai et al.,2003).

1.4 The lip-nose complex

The nose and the upper lip form the lip-nose complex. The lip nose complex occupies the central, midline position in the face making it a powerful determinant of facial attractiveness. The ideal proportion of the lips and nose complex plays an important role in maintaining well balanced and harmonic features (Azaria et al., 2006). In 2009, nose reshaping was one of the top five sought after cosmetic procedures in America, charting a 34% increase compared to the number of procedures done in year 2000 (ASPS, 2009). An increasing number of patients are concerned with the appearance of their lip. Whether their lips are thin as a part of the aging process or due to a constitutional problem, the need for full, sexy everted lips are ever more seen today (Azaria et al., 2006). In our study seven measurements involving the upper lip, philtral complex and nasal region were measured.

The lip-nose complex is also the region involved in cleft lip pathology. Cleft lip, with or without clefting of the primary and secondary palate, is the commonest congenital deformity of the oro-facial region (Alam, 2009). In Malaysia the incidence of cleft lip and palate has been reported to range between 1 per 941 live births (Alam, 2009) to 1.24 per 1000 lifebirths (Boo and Arshad, 1990). In bilateral cleft lip pathology, the reconstructive surgeon is faced with the challenge of performing a balanced bilateral lip repair without the aid of a normal side. Lip-nose complex

anthropometry at various ages provides measurements that serve as a guideline for reconstruction of various deformities involving these structures, especially when the pathology is bilateral (Prasad and Reddy, 2002). In these situations, having local ethnic and gender based data on the normal morphology at various ages will help to achieve a more satisfactory outcome.

1.5 Growth patterns of the lip-nose complex

Maturation date of a particular anatomical structure decides the timing of surgical repair for that structure. The maturation age of the structure in return is decided by the growth pattern. (Khandekar et al., 2005)

Knowledge of the growth pattern of the nose, upper lip and their individual parts from one year to maturation in a healthy population can help the surgeon appreciate variations from normal, understand altered proportions, and select an optimal time for correction of a facial deformity (Farkas et al., 1992).

Farkas et.al. (1992a-c) published a series of studies of the growth patterns of the individual components of the face. From his study of the nasolabial region (Farkas et al., 1992c), he observed that the nose height became fully developed in males at 15 years, reaching 97.9% of its size at 18 years of age. In females the nose height became fully developed at 12 years of age, attaining 96.55 of the 18-year old value. The differences between the findings at the time of maturation and 18 years were negligible. The nose width matured at 14 years in males and at 12 years in females. Nasal tip protrusion matured at 16 years in males and 14 years in females. The cutaneous upper lip height matured at 6 years in males, reaching 97.3% of its height at 18 years,

while in females, this measurement reached its maturation at 3 years (94.1% of its height at 17 years). The last growth spurt in this region for males was noted between 9 and 10 years of age (1.1mm) whereas the females had two late growth spurts at 12-13 years and 15-17 years, adding an additional 1.8mm to the cutaneous upper lip.

In a related study of anthropometry of the head, adult head height was approached at 13 years in both sexes. (Farkas et al.,1992a) Head length reached full maturation at 10 years in females and 14 years in males. With regards to growth patterns of the face, Farkas et al. (1992c), found that the face matured between 12 and 15 years in males and two years earlier in females.

Akguner in 1998 performed a cephalometric study on the adolescent growth patterns of the bony and cartilaginous framework of the nose. He evaluated age related growth changes in the bony and cartilaginous framework of the nose. The nasal height and nasal bridge length become fully mature in males at 15 years and in females at 12 years. The upper nasal dorsum, lower nasal dorsum, anterior nasal depth and posterior nasal depth exhibited continuous growth up to 14 years in males and 12 years in females. Nasal tip protrusion approached its mature size in males at 15 years and at 13 years in females.

A study done on the Indian population by Prasad and Reddy (2002) measured 500 Indians categorized according to age into four groups: 0-2years, 3-5years, 6-12 years and over 12-years. Another study showed differences in growth patterns for Indians compared to Caucasians and Blacks. (Khandekar et al., 2005)

1.6 Anthropometric instruments and landmarks

The standard instruments (e.g. sliding and spreading calipers) that are used in physical anthropology are made of metal, and the metric tape is made of fabric and has a millimeter scale. A general rule when measuring between two soft landmarks is that the hard tips of the sliding caliper touch, but do not press on the skin surface. On the other hand, the blunt pointers of the spreading calipers are pressed against the bony surface when measuring between bony landmarks. When measuring the circumference, the length, or the widths of the face, the examiner must be certain that the metric tape or tips of the caliper are sufficiently pressed against the bone surface of the skull to eliminate the effect of the varying thickness of the subcutaneous tissue. For measurement, the head of the examiner must be level with the head of the subject. Rest position of the head is determined by the subject's own feeling of the natural head balance (Farkas, 1994). However, determination of the angle sizes and most of the linear measurements are not influenced by the position of the head. Full exposure of the soft nose (including columella, nasal floor and nostrils) and the upper and lower lips in the frontal plane is facilitated when the head is in the reclining position.

Precise location of the landmarks on the surface of the head and face is essential for the reliability of linear or angular measurements. In this study, there are four measurements taken in the nasal region (refer Figure 2). The first is nose width or alare-alare (al-al), with alare being the most lateral point on each alar contour. The second is subnasale'-subnasale' (sn'-sn'), with subnasale' being the midpoint of the columella crest where the width of the columella is measured. The third is dome height or subnasale – pronasale (sn-prn). The subnasale is the midpoint of the angle at the columella base where the lower border of the nasal septum and the

surface of the upper lip meet. The pronasale is the most protruded point of the apex nasi, identified in the lateral view of the rest position of the head. The final nasal measurement is columella height or the midpoint between the highest point of the columella (c') and the subnasale (sn).

There are three measurements involving the lip in this study (refer Figure 2). The first is the lip width cheilion – cheilion (ch – ch) with cheilion being the point located at each labial commissure. The next measurement is the vertical height of lip measured from the crista philtri (cph) to the subnasale (sn). The cph is the point on each elevated margin of the philtrum just above the vermilion line. The final lip measurement is the philthral width or cph – cph.

1.7 Sources of error in anthropometry and anthroposcopy

The commonest sources of error in measurement are improper identification of landmarks, lack of proper use of measuring equipment and improper measuring technique (Farkas, 1994). Techniques of reducing these errors include marking the position of the landmarks on the skin with a skin-marking pen, taking the measurements twice and then determining the average of the two readings and practice in taking the measurements.

1.8 Evaluation of anthropometric findings

There is a system of quantitative criteria to help determine if the measurements obtained from the subjects are normal or abnormal (Farkas, 1994). The normal range of measurements is given by the mean +/- two standard deviations (SD). Measurements within +1SD and -1SD of the

mean are regarded as optimal (Farkas, 1994). Measurements smaller than -2SD is referred to as subnormal whereas measurements more than +2SD are referred to as supernormal.

In proportion indices, a value in the range of +/- 1SD of normal indicates proportionality i.e harmony. Index values at the mean +/- 2 SD designate disharmony. Harmony can be produced not only by two optimal measurements but also by two subnormal measurements with the same degree of defectiveness. Disharmony is most often caused by two normal measurements located at the extremities of the normal range (Farkas, 1994).

1.9 The history of facial measurement

Measurements of the human face as part of the body have been performed since the Greek era, and many aspects of ancient measurements can be found in modern clinical anthropometry (Porter, 2004). These include the Greek proportion sciences, the golden proportion and canons of important Renaissance artists. Facial measurements were first performed by the Greeks as part of total body measurements. However, these proportions were not true measurements but were determined by the preference of the artist or scientist.

Around 450 BC, Polykleitos and created a series of statues based on his Canon, that provided the basis of human aesthetics to this day. A thousand years before the Renaissance, Vetruvius, a Roman architect, expanded on the Canon, and described the proportions of the human face with mathematical detail (Porter, 2004).

1.10 The neoclassical facial canons

Neoclassical canons of facial proportion were derived by the artists and anatomists of the 17th and 18th centuries. A total of 11 canons have been described. The first neoclassical canon states that the head can be divided into equal halves at a horizontal line through the eyes. The second neoclassical canon states that the face can be divided into equal thirds, with the nose occupying the middle third. The third neoclassical canon states that the head can be divided into equal quarters, with the middle quarters being the forehead and nose, respectively. Neoclassical canon 4 states that the length of the ear is equal to the length of the nose. The fifth neoclassical canon states that the distance between the eyes is equal to the width of the nose. The sixth neoclassical canon states that the distance between the eyes is equal to the width of the each eye. The seventh neoclassical canon states that the width of the mouth is one and one-half times the width of the nose. The eighth neoclassical canon states that the width of the nose is one-forth the width of the face. The ninth neoclassical canon states that the nasal bridge inclination is the same as the ear inclination. The tenth neoclassical canon states that the lower face can be divided into equal thirds. The last or eleventh neoclassical canon states that the lower face can be divided into equal quarters.

However, newer anthropometrical measurements of the human face challenge previously accepted canons of the classical period. In a study of 153 North American Caucasians, Farkas et al. (2007) found that ancient canons do not fit average facial proportions. Other studies also confirm that the neoclassical canons have little applicability to white, Asian, Carribean and African American populations (Farkas et al., 2000, Porter and Olsen, 2001, Farkas et al., 1985)

1.11 Perception of facial attractiveness

The concept of facial attractiveness is a complex assimilation of innate perceptions and cultural stereotypes (Cunningham, M.R.,1986). The scientific field of facial attractiveness has come into its own in the past 30 years with over 2000 articles being published dealing with the subject since 1970 (Bashour, 2006). Although most of this research has been conducted in disciplines outside of plastic and reconstructive surgery, there are many discoveries that can be applied by facial cosmetic, plastic and reconstructive surgeons. Beginning from the time of Polycleitus (circa 450 to 420BC) who first defined the facial canons, artists and sculpturers, have created the human figure in what they perceived as beauty.

Four cues have been proposed to influence facial attractiveness. They are averageness, symmetry, sexual dimorphism and youthfulness/neoteny.

The average cue states that faces that conform more to the prototype face is perceived to be attractive and is a valued signal in mate choice. Rubenstein et al. (2001) believe that averageness is both necessary and sufficient to ensure facial attractiveness.

Symmetry of the physical traits is well known for contributing to facial attractiveness. It is well recognized that obviously distorted asymmetrical faces (as in many craniofacial syndromes) are unattractive (Bashour, 2006). Lower symmetry has been associated with losses in fitness components. A lack of symmetry in traits that are symmetrical at the population level is termed fluctuating asymmetry (Bashour, 2006). Those with a decrease in fluctuating asymmetry have

been associated with having higher mating success (Moller and Thornhill, 1998), more sexual partners (Thornhill and Gangestad, 1994), more offspring and fewer serious disease (Waynforth, 1999). They were also found to have more partners outside their primary partners, were the choice of women for extra pair copulation and had fitter sperm (Manning et al., 1998).

Sexual dimorphism looks into the difference between the male and female face. All fetuses are morphologically female at the time of conception and male individuals are created from the effect of intrauterine testosterone and testosterone receptive hormone (Bashour, 2006). Extreme female faces belong to women with extremely low testosterone-to-estrogen ratio and extreme male faces belong to men having a very high testosterone-to-estrogen ratio. It has then been found that extremes of sexual dimorphism are perceived as more attractive. Sexual maturity features in humans are those that exaggerate the difference between adults and children and between male and female individuals (Enlow and Hans, 1996).

Neoteny denotes babyness and is different from youthfulness. Neonate features are characteristics of newborns i.e., large eyes, small nose, round cheeks, smooth skin, glossy hair and lighter coloration. Neonate features in humans tend to be attractive to perceivers (Todd et al., 1980). Parents have been found to respond more positively to cuter infants (more neoteny). Adults from both genders with neonate features such as larger eyes and relatively smaller noses were perceived as more attractive than those with small eyes and relatively larger noses. (Cunningham, 1986). The preference for neoteny features have been found across a range of ethnic populations (Jones, 1993, 1995) In his study on north American Indian woman, Husein et al., (2009) reported that most minority individuals seek to maintain their ethnicity

through cosmetic surgeries. The women in his study who perceived themselves as being attractive reported higher self-esteem scores than the other women. Among Indian women, the eyes were the feature most self-liked. This correlates with the perception that Indian women are often known for their beautiful eyes. Therefore many aesthetic procedures strive to change the size or position of unharmonious feature to divert attention back to the eyes. Reduction rhinoplasty, blepharoplasty and browlift are some examples.

When planning facial cosmetic, plastic or reconstructive surgery, the surgeon should take into account these four features of facial attractiveness. The aim of the surgery should be to produce a face that is close to the prototype associated with the population operated on.

1.12 Cross-Sectional Method of Study

In a cross sectional study, the subjects are examined at certain ages. Such a study is performed only once within a single time period. The measurements are taken on samples of individuals of like age, one sample for each group studies (Pruzansky, 1977).

Cross sectional studies are by far the commonest and least expensive method used in medically oriented anthropometric studies (Farkas, 1996). Benefits of cross sectional studies include requiring a minimal number of investigators who can then examine a relatively large study group, a comparatively short duration of time for completion of the study, maintenance of a low budget throughout the study, the increased number of measurements that can be taken by a single investigator and it provides a representative population sample whereby the required ethnic and

socio-economic mixtures can be obtained by recruiting subjects from daycare centers, kindergartens, schools and others.

On the other hand, the downside of cross sectional studies is that the growth studies have limited value, providing only a rough estimate of velocity (Tanner, 1962). Pruzansky (1977), claims that the individual growth patterns are obscured. However, Farkas (1996) compared his data from cross sectional developmental studies on the head, face and nose with longitudinal studies of Davenport (1940) and Scott (1967) and found them to be comparable.

Apart from that, differential sampling of age groups is also a disadvantage as the different environmental/cultures histories can affect the variables within the cohort group, for example a generational variable (Farkas,1996).

The other study design that could be used for anthropological studies are longitudinally designed studies. Subjects are examined regularly at specific ages, over a period of time. Longitudinal data is essential to document the variability of the velocity from one year to another (Tanner, 1962). It also offers information on the pattern, changes, velocities and acceleration of growth (Low, 1970).

There are a number of disadvantages of longitudinal studies. They require a large number of investigators and run over a longer time frame. Even though the study may begin with an adequate number of sample size, the loss of subjects is inevitable, be it due to absence, illness, withdrawal from the study or migration. It is difficult to select a population sample that

represents the ethnic group, socioeconomic class and other environmental elements and maintain it for a long duration of time, especially in a multiethnic society. Systematic sampling undertaken in longitudinal sampling is said to be biased and cannot be compared to the comprehensive subjects that one would obtain in a cross-sectional study. The variables that can be studied are also limited as compared to a cross-sectional study. Errors may also result when there is a change in the investigator or measuring tool which is bound to happen with time. These studies are also costly in terms of staff, logistics and data analysis. Lastly, data obtained for the youngest age group may become out-of-date by the time of completion of the study.

2.0 OBJECTIVES OF STUDY

2.1 General

To obtain a baseline of normal parameters of the lip-nose complex among the Malay, Chinese and Indian population in Kuala Lumpur by sampling healthy young adults at 16 years of age.

2.2 Specific

1. To determine the normal parameters of the lip-nose complex among Malays, Chinese and Indians in Kuala Lumpur.

2. To compare the variation of the lip-nose complex between the male and female gender among the study population.

3. To compare the variation of the lip-nose complex parameters among Malays, Chinese and Indians in Kuala Lumpur.

3.0 MATERIALS & METHOD

3.1 Location

The study was carried out in three schools in Wilayah Persekutuan, Kuala Lumpur, Malaysia. There is an estimated population of 1.475 million people in Kuala Lumpur (World Gazetteer, 2010).

There are numerous primary, secondary and tertiary schools to meet the needs of the children. There are 96 secondary schools in Wilayah Persekutuan Kuala Lumpur (JPWP, 2010). Schools in the city were chosen as the student population would be a fair representation of the ethnic groups of various descent found in Malaysia. Certain areas are populated by ethnic groups of a specific descent. For example if the study was done in Klang, Selangor, the Malay population would be representing Javanese Malays, the Chinese students may be representing the Hokkien community and the Indian subjects may be representing the Sri Lankan community.

3.2 Study design

Anthropometric measurements were carried out on subjects using a cross sectional, descriptive study design.

3.3 Study population

The study population in this study was 16 year old students studying in three chosen schools in Wilayah Persekutuan Kuala Lumpur. The three schools were Sekolah Menengah Bukit Bandaraya, Sekolah Menengah Vivekananda and Chong Hwa Independent High School Kuala

Lumpur. There were 154 sixteen year old students in Sekolah Menengah Bukit Bandaraya. Of these, 71 were males and 83 were females. In Sekolah Menengah Vivekananda there were 195 sixteen year old students, 93 males and 102 females. Lastly there were 789 sixteen year old students in Chong Hwa Independent High School, 406 male and 383 female.

3.4 Sample frame:

The sample frame consisted of all secondary schools in Wilayah Persekutuan Kuala Lumpur whilst the sampling unit was the individual schools. From the sampling units, 300 subjects were chosen for data collection. Each was healthy 16 year olds who fulfilled the inclusion criteria.

3.4.1 Inclusion criteria:

Normal, healthy individuals from Malay, Chinese and Indian ethnicity. They must have a history of at least three consecutive generations of similar ethnic group. (No history of inter-racial marriages).

3.4.2 Exclusion Criteria:

Subjects with:

Orofacial or craniofacial clefts or syndromes.

Mental retardation.

Systemic illnesses such as diabetes mellitus, hypertension, systemic lupus erythematosus, rheumatoid arthritis, poliomyelitis and dermatomyositis.

Mixed ethnic background – a history of inter-racial marriage in any of the three preceding generations of family members.

Previous facial plastic or reconstructive surgery

Major facial trauma

Noticeable facial disfigurement

Respiratory disease or common cold

3.5 Sample size

One-way ANOVA was used to calculate the sample size based on previous anthropometric studies done among various ethnic races. Sample sizes of 31, 31, and 31 are obtained from the 3 ethnic groups whose means are to be compared. Therefore the total sample of 93 subjects achieves 81% power to detect differences among the means versus the alternative of equal means using an F test with a 0.05000 significance level. The size of the variation in the means is represented by their standard deviation which is 0.33. The common standard deviation within a group is assumed to be 1.00. Therefore, in this study, we included 50 subjects for each gender from each of the ethnic groups studied i.e. 50 Malays males, 50 Malay females, 50 Chinese males, 50 Chinese females, 50 Indian males and 50 Indian females. This made up a total of 300 subjects in the study.

3.6 Measuring instruments

The measurement instruments used in this study were Standardized Castroviejo calipers, sliding calipers, flexible tape measure and metal ruler.

3.7 Data collection process

3.7.1 Preparation for fieldwork and logistics support

The research proposal was presented to the Research Committee and Ethics Committee of the School of Medical Sciences, Universiti Sains Malaysia. Written approval was then obtained from the Research Committee, School of Medical Sciences, Universiti Sains Malaysia (letter attached as Appendix A) and the Ethics Committee (Human), Universiti Sains Malaysia (letter attached as Appendix B).

An official letter was then sent to the Ministry of Education to obtain permission to carry out this research study. Written approval was obtained from the Education Policy Planning and Research Unit, Ministry of Education, Malaysia. Written approval was conferred by the Research and Evaluation Sector, Education Policy Planning and Research Unit, Ministry of Education, Malaysia (letter attached as Appendix C).

Approval was then sought from the Department of Education, Wilayah Persekutuan Kuala Lumpur and written approval was obtained from the Department of Education, Wilayah Persekutuan Kuala Lumpur (letter attached as Appendix D).

Once all the necessary clearance was obtained, the relevant schools headmistress was approached. Ties were made with the Vice Principal (Student Affairs), the School Counselor and the respective class teachers during preliminary visits to the schools.

3.7.2 Consent from parents

Consent forms (attached as Appendix E) were distributed prior to the data collection date and the nature of the study was described in detail to the students. The students then went back home and obtained written consent from their parents for participation in this study. The consent form was then collected back data collection began.

3.7.3 Data Collection

Data collection was carried out between 18.08.10 and 27.08.10. Sixteen year old students with approved consent letters who fulfilled the criteria were measured until the required number for the particular gender and ethnic group was obtained. The measurements were either carried out in the classroom, in the school hall or in designated rooms according to the convenience of the teachers and students.

3.7.4 Steps taken to increase accuracy of the data collection

When dealing with the schools, care was taken to ensure that the teachers and students were not burdened by the presence of the investigator during data collection.

Special care was taken in explaining the nature of the study and the areas in which the data could be utilized. This was done to increase the number of subjects who received consent from their parents. Care was also taken to explain the type of measurements taken and that it was external measurements that were simple and pain free.

The students were engaged in preamble to take away anxiety. Therefore, measurements could be taken in a relax state and this would increase accuracy of measurement.

Initial refusal for consent by parents was overcome by courteous persuasion and by reiterating the usefulness of the data collected. However, if the parents/students still did not consent, they were not forced to participate in this study.

Data collection proformas were created and used to document data in an orderly and consistent manner. (proforma attached as Apppendix F).

The measurements were taken by a single investigator to improve accuracy. The measurements were also repeated twice to obtain an average reading. Some children had to be measured repeatedly because they were fidgety or ticklish and this was dealt with in a professional manner and measurement was repeated until two reliable measurements were taken.

3.7.5 Quality control procedures

At the end of every data collection day, all the proformas were checked to see if any information had been left out. The total number of subjects interviewed was categorized according to gender and ethnic group and the numbers were tallied daily.