Original Article

Normal Nasal Anthropometric Values of Pre-school Age Northeastern Thai Children

Winaikosol K, MD[1], Patthanapalakornskul J, MD[2], Punyavong P, MD[1], Jenwitheesuk K, MD[1], Surakunprapha P, MD[1], Chowchuen B, MD, MBA[1]

[1] Plastic & Reconstructive Unit, Department of Surgery, Faculty of Medicine, Khon Kaen University, Khon Kaen, Thailand
[2] Plastic & Reconstructive Unit, Department of Surgery, Rayong Hospital, Rayong, Thailand

Background: Successful surgical correction of craniofacial disfigurement depends on precise knowledge of the craniofacial norms specific to the patient's ethnic group.

Objective: This study sought to determine the anthropometric measurements of normal nasal parameters in preschool-age northeastern Thai children.

Materials and Methods: The nasal aesthetic parameters of 30 children, age of four to seven years, in northeast Thailand were evaluated using a 3-D camera of four distances, one angle, and three ratios.

Results: The normal values of each of the eight parameters listed above were determined by age group. Mean length of nasal width, nasal tip height, dome height and columellar height were 30.87 mm, 13.17 mm, 7.73 mm and 5.63 mm respectively. The columella-labial angle was 116.10 degree.

Conclusion: The shape and proportions of the nose in Thai children of preschool age often differ from those of children ethnicities. The assessment of and guidelines for corrective surgery should be based on standard values that are specific to this group.

Keywords: Normal child, Nasal aesthetic parameters, Anthropometry, 3D photo, Pre-school age, Thai

J Med Assoc Thai 2019;102(Suppl.5): 1-4
Website: http://www.jmatonline.com

The most common congenital craniofacial anomalies in Thailand are cleft lip and cleft palate, with the highest incidence being in the northeast (1.66 per 1,000 livebirths)[1]. Cleft lips can be classified as either unilateral or bilateral. Deformities are more severe in cases of bilateral cleft lip and include shortness of the columella, wide nose, wide base ala, and flat and broad nasal tips[2-5].

Nasal deformities from cleft lip can be classified as primary (deformation/malformation) or secondary (post-operative distortion). The goal of reconstruction is to achieve an aesthetic nasal pattern that is as close as possible to the norm. Mulliken[6] proposed synchronous repair of nose and lip and premaxillary-maxillary cleft. The technical stratagems to model the nose are: 1) alignment of the premaxilla and 2) anatomical placement of the ala cartilage and sculpturing of the overlying soft tissue.

There are various tools that can be used to evaluate the outcomes of cleft lip repair. Long-term nasal aesthetic outcomes can be evaluated by anthropometric measurements of nasal tip height, alar width, columellar length, dome height, and columella-labial angle[7,8]. These parameters should be evaluated at four to six years of age, as these are the ages at which children begin to engage in social interactions.

The anthropometric measurements of the nose tend to vary ethnicity. The nose in patients of Asian descent (especially those of Southeast Asia descent) tend to exhibit less projection of the tip and root, a wide alar base, and more obscure tips[9,10]. Reference data regarding the normal nasal aesthetic parameters in patients of a given ethnicity are necessary to assess whether or not a patient needs to undergo surgical correction of a residual cleft lip nose deformity. However, we were able to find no report describing these parameters the normal anthropometry of the nose in preschool-age Thai children.

Correspondence to:
Winaikosol K.
Plastic & Reconstructive Unit, Department of Surgery, Faculty of Medicine, Khon Kaen University, Khon Kaen 40002, Thailand.
Phone: +66-43-363252, **Fax:** +66-43-348393
E-mail: kengkawi@kku.ac.th

Materials and Methods

This study was performed at the Tawanchai Cleft Center at Khon Kaen University's Srinagarind Hospital. This study was reviewed and approved by the Khon Kaen University Ethics Committee for Human Research (HE581217). The nasal anthropometric measurements of 30 children, age of four to seven years, in northeast of Thailand were evaluated using three-dimensional photos (3-D optical scanning system; Morpheus 3-D; Morpheus Co, Gyeonggi, Korea) rendered from the front and at 45-degree lateral views

How to cite this article: Winaikosol K, Patthanapalakornskul J, Punyavong P, Jenwitheesuk K, Surakunprapha P, Chowchuen B. Normal Nasal Anthropometric Values of Pre-school Age Northeastern Thai Children. J Med Assoc Thai 2019;102;Suppl.5: 1-4.

on either side by computer software (Morpheus 3D Dental Solution Version 3.0.14.3).

Measurements

All photos were taken and measured by single investigator (JP) under the same conditions. The reference points were marked at the pronasal, the most prominent point of the nasal tip (Prn), subnasale (Sn; the midpoint of the columella base at the columella-labial junction), ala (Al; the most lateral point of the nasal wing surface), and C point (the most superomedial point of the nostril aperture; Figure 1).

The parameters measured were the nasal tip height (Sn-Prn; the vertical distance between subnasale and the pronasal), the nasal width (Al-Al; the horizontal distance between alar points), columella height (Sn-C; the vertical distance between the most superomedial point of the nostril aperture and the subnasale point), dome height (C-Prn; the vertical distance between the most superomedial point of the nostril aperture and the subnasale), and columella-labial angle (CLA; the angle formed by the inferior border of the columella and the labial surface of the upper lip; Figure 2).

Three nasal proportion ratios were calculated: (1) nasal tip height to nasal width, (2) columellar height to nasal width, and (3) dome height to columellar height. All distance are expressed in millimeters, and the CLA expressed in degrees.

Statistical analysis

The statistical analysis was performed with STATA version 12.0 (version 12.0, SPSS Inc., Chicago, IL, USA). The average of the three exported anthropometric absolute measurements was adopted as each individual's personal measurement. Anthropometric indices (eight items) were calculated using the exported data. Following basic statistics, such as mean value, standard deviation, minimum value, and maximum value, were calculated for the absolute anthropometric measurement and indices.

Results

By measuring nasal parameters we were able to determine the normal nasal shape in term of width, tip height, dome height, columellar height, and columella-labial angle. In addition to these quantitative measurements, it is also important to determine the proportions of the nose in order to ascertain its shape. The aesthetic shape of basal nasal proportion can be evaluated based on the ratios of nasal tip height to nasal width, columellar height to nasal width, and dome height to columellar height. Data with regard to these parameters in preschool-age children are shown in Table 1, and those for all reported parameters by age are shown in Table 2.

Discussion

It is important consider both quantitative aesthetic

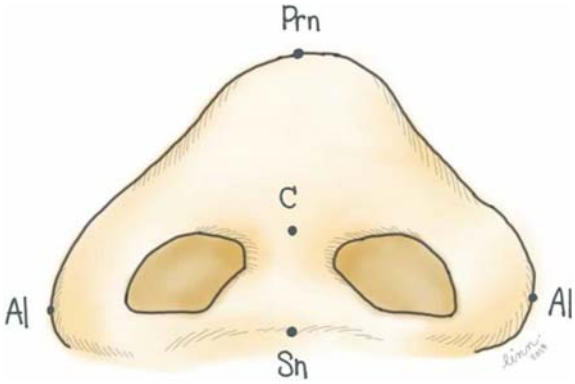

Figure 1. Nasal reference points.

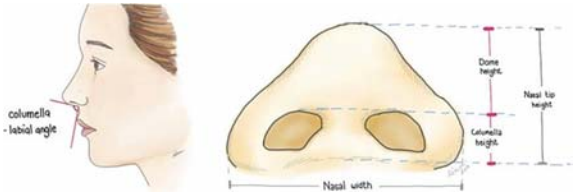

Figure 2. Parameter measurements.

Table 1. Normal nasal parameters in preschool-age children

Parameters	-2SD	-1SD	Mean	SD	+1SD	+2SD
Nasal width (mm)	28.09	29.48	30.87	1.39	32.25	33.64
Nasal tip height (mm)	11.51	12.34	13.17	0.83	13.99	14.82
Dome height (mm)	5.10	6.41	7.73	1.32	9.05	10.37
Columellar height (mm)	3.81	4.72	5.63	0.91	6.54	7.46
CLA (degree)	93.17	104.64	116.10	11.46	127.56	139.03
NTH: NW	0.35	0.39	0.43	0.04	0.47	0.51
CH: NW	0.13	0.16	0.18	0.02	0.21	0.23
DH: CH	0.65	1.03	1.42	0.39	1.81	2.20

CLA = columella-labial angle; NTH: NW = nasal tip height: nasal width; CH: NW = columellar height: nasal width; DH: CH = dome height: columellar height

Table 2. Normal nasal parameters by age

Age	-2SD	-1SD	Mean	SD	+1SD	+2SD
Nasal width (Al-Al, mm)						
4	28.09	29.48	30.87	1.39	32.25	33.64
5	25.69	28.01	30.33	2.32	32.65	34.96
6	26.84	29.09	31.33	2.25	33.58	35.83
7	22.66	26.49	30.33	3.83	34.16	37.99
Nasal tip height (Sn-Prn, mm)						
4	11.51	12.34	13.17	0.83	13.99	14.82
5	10.80	11.66	12.53	0.87	13.39	14.26
6	11.96	12.76	13.62	0.83	14.46	15.29
7	10.00	11.72	13.44	1.72	15.16	16.88
Dome height (C-Prn, mm)						
4	5.10	6.41	7.73	1.32	9.05	10.37
5	5.87	6.65	7.43	0.78	8.21	8.99
6	6.28	6.99	7.70	0.71	8.41	9.12
7	4.93	6.42	7.90	1.48	9.38	10.87
Columellar height (Sn-C, mm)						
4	3.81	4.72	5.63	0.91	6.54	7.46
5	3.27	4.45	5.64	1.19	6.83	8.02
6	4.56	5.61	6.66	1.05	7.71	8.76
7	3.74	5.08	6.43	1.34	7.77	9.11
Columellar-labial angle (CLA, degree)						
4	93.17	104.64	116.10	11.46	127.56	139.03
5	99.66	107.77	115.89	8.11	124.00	132.11
6	104.28	110.73	117.18	6.45	123.63	130.08
7	98.78	111.62	124.46	12.84	137.31	150.15
Nasal tip height: nasal width (NTH: NW)						
4	0.35	0.39	0.43	0.04	0.47	0.51
5	0.34	0.38	0.41	0.04	0.45	0.49
6	0.36	0.40	0.44	0.04	0.48	0.52
7	0.38	0.41	0.44	0.03	0.48	0.51
Columellar height: nasal width (CH: NW)						
4	0.13	0.16	0.18	0.02	0.21	0.23
5	0.11	0.15	0.19	0.04	0.22	0.26
6	0.13	0.17	0.21	0.04	0.26	0.30
7	0.14	0.18	0.21	0.04	0.25	0.28
Dome height: columellar height (DH: CH)						
4	0.65	1.03	1.42	0.39	1.81	2.20
5	0.33	0.87	1.41	0.54	1.95	2.49
6	0.71	0.95	1.13	0.24	1.43	1.66
7	0.62	0.95	1.28	0.33	1.60	1.93

parameters and proportions of nose. Because nose shape varies by ethnicity, the normal nasal parameters for people of various ethnicities should be studied. Even among children of Asian descent, these parameters tend to vary by country[11].

When children reach preschool age, they begin to engage in social interactions, and aesthetic differences may lead them to being socially stigmatized. Understanding the normal parameters of the nose can help in determining if there is a need for cleft lip nose revision surgery.

We reported these data as range of mean and standard deviation. We considered data within the range of mean $\pm$1 SD to be within the normal range, and values equal to or greater than mean $\pm$2 SD to be outside the normal range[12]. Indices smaller than the lowest index value (mean -2 SD) were determined to be subnormal, and those that exceeded the highest normal value (mean +2 SD) to be supernormal.

This study did not employ direct measurement due to its being time consuming and requiring the children's cooperation. Instead, the authors took measurements using a three-dimensional camera, which is less difficult than direct measurement and yield reliable values.

Conclusion

Normal nasal parameters for their evaluation and reconstruction planning should take ethnicity into account.

What is already known on this topic?

The differences in normal nasal parameters of preschool-age children of Thai descent compared to those of Caucasian or other Asian children.

What this study adds?

Our study was able to determine the normal nasal parameter and ratio in pre-school age children of Thai descent, which can be used as referent values for nasal reconstructive surgery.

Acknowledgements

The authors would like to thank Dr. Natthaporn Piyasatukit for providing illustration in this manuscript for the Cleft Lip-Cleft Palate and Craniofacial Deformities, Khon Kaen University under Tawanchai Royal Grant Project (Tawanchai Center) for its support. This study was funded by a grant from Khon Kaen University Faculty of Medicine, in Thailand.

Potential conflicts of interest

The authors declare no conflicts of interest.

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