

What Is the Most Beautiful Facial Proportion in the 21st Century? Comparative Study among Miss Universe, Miss Universe Thailand, Neoclassical Canons, and Facial Golden Ratios

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Background: An ideal facial proportion has been attempted since the ancient times. However, modern facial proportions of the most beautiful women in the 21st century are unavailable and have never been determined.

Methods: A retrospective review of the photographs of Miss Universe Thailand and Miss Universe from 2001 to 2015 was conducted. All photographs were searched from Internet websites. Twenty-six dominant points were identified. Comparisons of the facial proportion among Miss Universe Thailand, Miss Universe, neoclassical canons, and facial golden ratios were performed.

Results: Sixteen Miss Universe Thailand and 16 Miss Universe were included. Nine points of facial proportions were found to be statistically significant between Miss Universe Thailand and neoclassical canons. Miss Universe Thailand showed wider nasofrontal angle, thinner lower-upper lip height ratio, and less chin projection. Ten points of facial proportions were found to be statistically significant between Miss Universe and neoclassical canons. Miss Universe showed wider nasofrontal and nasofacial angle, more nasal tip projection, and thinner lower-upper lip height ratio. Seven points of facial analysis were found to be statistically significant between Miss Universe Thailand and Miss Universe groups. Of the 16 facial golden ratios, 12 demonstrated statistical significance in both the Miss Universe Thailand and Miss Universe groups.

Conclusions: Modern facial proportions of beauty are different from the past. Photogrammetric analysis demonstrated longer forehead, thinner lower-upper lip height proportion, wider interala-medial canthus width proportion, and wider nasofrontal angle compared with previous references. Furthermore, facial golden ratios were statistically significantly invalid in modern facial proportions of beauty. (*Plast Reconstr Surg Glob Open* 2019;7:e2044; doi: 10.1097/GOX.0000000000002044; Published online 11 February 2019.)

INTRODUCTION

Advances in plastic surgery can make incredible facial change including soft tissue and skeletal profiles. Although facial attractiveness has been thought to be based on indi-

vidual taste, culture, popular trend, and sex difference,^{1,2} according to a hypothesis, in a harmonious face, certain fixed ratios exist between different parameters.³

Definition of the ideal facial proportions of beauty has been attempted since the ancient times, with neoclassical canons and facial golden ratios being the most referenced. However, perception of facial attractiveness has changed over time. Moreover, standard references of facial proportions were analyzed in ancient normal populations, but modern facial proportions of the most beautiful women in the 21st century have never been investigated.

The Miss Universe contest is known to be the paramount beauty contest and its winner is considered the most beautiful woman in the world. The objective of this study was to analyze the facial proportions of the most beautiful women in the 21st century based on the winners of Miss Universe Thailand and Miss Universe and compare

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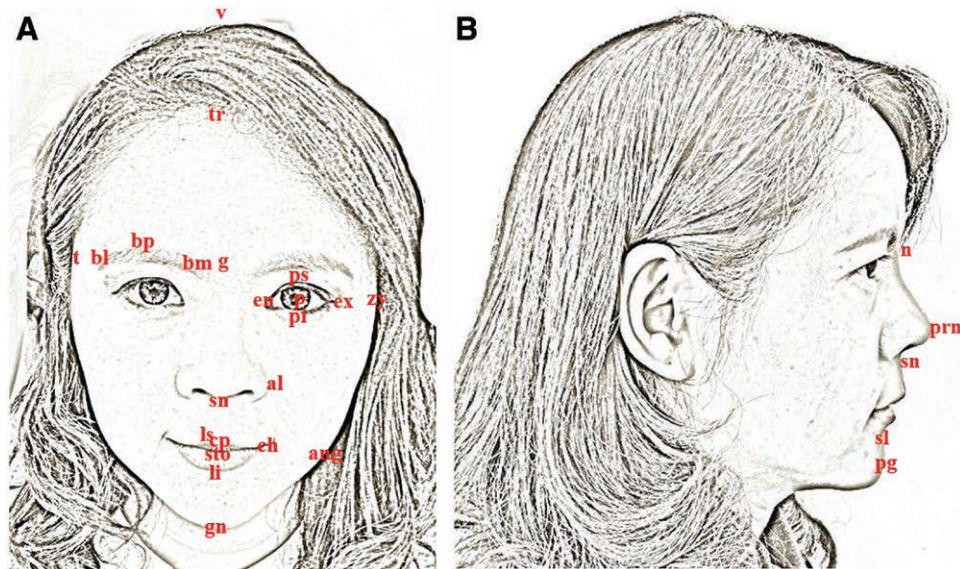


Fig. 1. The 26 dominant points are identified. A) the true neutral anteroposterior view and B) the true lateral view.

their facial proportions with those of neoclassical canons and facial golden ratios.

METHODS

This study was approved by the ethics committee of Phramongkutklao Hospital and College of Medicine. A retrospective review of the photographs of Miss Universe Thailand and Miss Universe from 2001 to 2015 was conducted. All photographs were searched from Internet Websites and stored in a computer as JPG files using Adobe Photoshop CS6 (Adobe Systems, San Jose, Calif.). If we did not find the optimal photographs for analysis, we captured photographs from the video clips from Internet websites. True neutral anteroposterior and lateral facial views were selected if the photograph met the following criteria⁴:

1. Photograph of the true neutral anteroposterior view shows the described landmarks as noted in Figure 1A, and both sides of the face should be as symmetric as possible. To limit rotation, the soft tissue landmark glabella should be positioned within 5% in the midline.
2. The soft-tissue trichion and gnathion points are completely visible. There are no silhouettes or irregular photographic shadows.
3. Photograph of the true lateral view shows align the nasal tip and chin. The contralateral eyebrow should not be visible (Fig. 1B).
4. Photographs for lip analysis were selected from the position of neutral lips and are closed smoothly as possible.
5. Photograph resolution should be more than 30 pixels/cm in Adobe Photoshop CS6 (Adobe Systems).

Twenty-six dominant points were identified (Table 1 and Fig. 1).

Human sculptures made in ancient Greece were derived from proportions that followed established rules or “canons.”^{5,6} These rules were incorporated in the neoclassical canons for the human face by Renaissance artists such as Leonardo da Vinci, Vitruvius, Bergmuller, and Durer.^{7,8} Subsequently, these canons were adapted by medical artists, anatomists, and aesthetic surgeons, and are still being used to this day.

Neoclassical canons and facial golden ratios are the most widely used references of beauty, thus, we used them to compare the facial proportions among Miss Universe Thailand and Miss Universe winners.

The following points were evaluated in the neoclassical canons analysis:

1. Two-section canon: the height of the vertex to the endocanthion is equal to the height of the endocanthion to the gnathion.
2. Three-section canon: the heights of the trichion to the nasion, of the nasion to the subnasale, and of the subnasale to the gnathion are equal.
3. Four-section canon: the heights of the vertex to the trichion, of the trichion to the glabella, of the glabella to the subnasale, and of the subnasale to the gnathion are equal.
4. Nasofacial proportion canon: the width of the alae is equal to a quarter of the width of the distance between the zygomas.
5. Orbitonasal proportion canon: the distance between the medial canthi is equals to the width of the ala.
6. Orbital proportion canon: the distance between the medial canthi is equal to the width of the eye fissure (medial to lateral canthus of the eye).
7. Naso-oral proportion canon: the width of the mouth is equal to 1.5 of the width of the ala. The width of the face can be divided into fifths.

Other facial proportion analysis including the following:

Table 1. Twenty-six Dominant Points Were Described

Abbreviation	Definition
1. Vertex (v)	The highest seen point on the head.
2. Trichion (tr)	The junction of hairline and forehead in the midline.
3. Glabella (g)	The most prominent point of forehead in the midline between the eyebrows.
4. Temporal (t)	The soft-tissue border of the temporal area, located at the most lateral points of the face depicted in works of art lying upon a line through the supraorbital foramen (left and right).
5. Medial eyebrow (bm)	Medial border of the eyebrow (left and right).
6. Lateral eyebrow (bl)	Lateral border of the eyebrow (left and right).
7. Peak of the eyebrow (bp)	The height of the eyebrows and often corresponds to the supraorbital foramen (left and right).
8. Nasion (n)	Point of greatest concavity of the nasal dorsum near a line level with the upper lid lash line.
9. Endocanthion (en)	Point of the medial canthus where the upper and lower lids join (left and right).
10. Exocanthion (ex)	Point of the lateral canthus where the upper and lower lids join (left and right).
11. Palpebrae superius (ps)	Superior border of the palpebrae (left and right).
12. Palpebrae inferius (pi)	Inferior border of the palpebrae (left and right).
13. Center of pupil (p)	The center point of the pupil.
14. Zygon (zy)	Lateral border of the cheek (left and right).
15. Pronasale (prn)	The highest point of the tip of the nose.
16. Ala (al)	The most lateral point on the rims of the alar wing of the nose (left and right).
17. Subnasale (sn)	The deepest point at the junction of the base of the columella and upper lip in the midline.
18. Cupid's peak (cp)	The peak of Cupid's bow.
19. Labial superius (ls)	The upper border of the upper lip.
20. Chelion (ch)	The oral commissure.
21. Labial inferius (li)	The lower border of the lower lip.
22. Stomion (sto)	The midline point where the upper lip touches the lower lip.
23. Sublabiale (sl)	The midline point at the junction of the lower border of the cutaneous lower lip and superior border of the chin, it is the deepest point of the labiomenal groove.
24. Mandibular angle (ang)	The angle of the chin according the line from the oral commissure.
25. Pogonion (pg)	The most prominent point of the chin in the midline.
26. Gnathion (gn):	The most inferior point of the lower border of the chin.

1. Nasal proportion analyzed by

- 1.1. Nasofrontal angle: the inner angle formed by a line tangent to the glabella and a line tangent to the nasal dorsum intersecting at the nasion.
- 1.2. Nasofacial angle: the inner angle formed by the intersection of the facial plane, from the glabella to the pogonion, and the nasal dorsal plane, from the nasion to the pronasale.
- 1.3. Nasolabial angle: the inner angle formed by a line tangent to the nasal columella and a line tangent to the upper lip intersecting at the subnasale.

2. Nasal tip projection analyzed by the ratio of

- 2.1. the ala to the tip of the nose and the nasion to the tip of the nose.
- 2.2. the tip of the nose to the upper lip and the upper lip to the ala of the nose.

- 3. Lower facial proportion analyzed by the ratio of the stomion to the gnathion and the subnasale to the stomion.
- 4. Oral proportion analyzed by the ratio of height of the lower and upper lips.
- 5. Chin projection measured by drawing a line from the glabella through the subnasale and another line from the glabella to the pogonion.

The facial golden ratios were measured in 16 proportions and divided into 11 vertical and 5 horizontal measurements. Eleven vertical measurements were performed in the following:

- 1. zygion-zygion:trichion-gnathion
- 2. trichion-endocanthion:endocanthion-gnathion

- 3. gnathion-ala:ala-trichion
- 4. endocanthion-ala:ala-gnathion
- 5. gnathion-chelion:chelion-endocanthion
- 6. chelion-ala:ala-endocanthion
- 7. ala-chelion:chelion-gnathion
- 8. endocanthion-chelion:endocanthion-gnathion
- 9. endocanthion-ala:endocanthion-chelion
- 10. ala-gnathion:endocanthion-gnathion
- 11. labial superius-stomio:stomion-labial inferius

Five horizontal measurements were made:

- 1. Intercanthal: horizontal measurement from the left exocanthion to the right exocanthion.
- 2. Interdacryon: horizontal measurement between the left endocanthion to the right endocanthion.
- 3. Interala: horizontal measurement between the left lateral rim to the right lateral rim of alar of the nose.
- 4. Interchelion: horizontal measurement from the left chelion to the right chelion.
- 5. Intertemporal: horizontal measurement from the left temporal to the right temporal measured along a line that passed through the estimated location of the supraorbital foramen.

Concerning the facial golden ratio measurement, an acceptance interval for a 2% error of 1.58–1.65 was determined, whereas the corresponding SD for Phi was set at 0.02.⁹

Outcome Measurements

The photographs used in this study were independently selected by 2 independent surgeons. The final photographs were agreement from both surgeons. The distances and angles were measured using Acrobat Reader, version

Table 2. Facial Proportions of Miss Universe Thailand and Neoclassical Canons

Facial Proportion	Description	Miss Universe Thailand* (n = 16)	Neoclassical Canons	P†
Two-section canon	Lower half: upper half	0.88±0.09	1	<0.001‡
Three-section canon	Middle part: upper part	0.99±0.10	1	0.613
	Lower part: upper part	1.00±0.12	1	0.896
Four-section canon	2 nd part: upper part	1.20±0.26	1	0.011‡
	3 rd part: upper part	1.18±0.25	1	0.015‡
	4 th part: upper part	1.18±0.20	1	0.003‡
Nasofacial proportion canon	Lateral canthus to temporal: intermedial canthus	0.87±0.23	1	0.044‡
		0.82±0.28	1	<0.001‡
Orbitonasal proportion canon	Eye width: interalar width	1.14±0.12	1	0.001‡
Orbital proportion canon	Interalar: intermedial canthus	0.93±0.12	1	0.044‡
Naso-oral proportion canon	Eye width: intermedial canthus	1.47±0.20	1.5	0.559
	Oral width: interalar width	1.17±0.14	1	<0.001‡
Nasal proportion	Nasofrontal angle	142.82±12.46	125–135 degree	<0.001‡
	Nasofacial angle	39.76±9.64	35–40 degree	0.076
	Nasolabial angle	104.57±6.31	105–108 degree	0.054
Nasal tip projection	Ala to nasal tip: nasion to tip	0.63±0.15	0.67–1	0.317
	Nasal tip to lip: lip to ala	0.67±0.17	0.67–1	0.999
Lower face proportion	Stomion to gnathion: subnasale to stomion	2.10±0.35	2	0.277
Oral proportion	Lower lip: upper lip height	1.48±0.37	2	<0.001‡
Chin projection		8.93±2.89	11 degree	0.015‡

*Values are presented as mean ± SD.

†One-sample *t* test.

‡Statistically significant.

XI (Adobe Systems). After the measurements were taken, the data were recorded in Microsoft Excel to compare the facial proportions. Comparison of facial proportions among Miss Universe Thailand and Miss Universe, neoclassical canons, and facial golden ratios were performed.

Statistical Analyses

Mann-Whitney *U* test was used for the comparison between the Miss Universe Thailand and Miss Universe groups. Student *t* test was used for the comparison of facial proportions among the Miss Universe Thailand and Miss Universe groups, neoclassical canons, and facial golden ratios. *P* value <0.05 was considered statistically significant.

RESULTS

From 2001 to 2015, 16 Miss Universe Thailand and 16 Miss Universes were included. The winner of Miss Universe Thailand competes in the Miss Universe pageant. In 2014, the winner of Miss Universe Thailand resigned 1 month after the contest and the first runner-up represented at the Miss Universe 2014 pageant; thus, we included both winners Miss Universe Thailand 2014 in this study. Of the 16 Miss Universe Thailand, 14 (87.5%) were of Thai ethnicity, 1 (6.25%) was Thai-Austrian, and 1 (6.25%) was Thai-German.

In 2002, the winner of the Miss Universe pageant was dethroned 4 months later and the first runner-up took over the Miss Universe title. Thus, we also included both winners of Miss Universe 2002 in this study. The 16 Miss Universe winners were from Asia (Japan and Republic of the Philippines), Europe (Russian Federation), Australia (Australia), Africa (Republic of Angola), and America (Commonwealth of Puerto Rico, Canada, Dominican Republic, United Mexican States, USA, Bolivarian Republic

of Venezuela, Republic of Panama, and Republic of Colombia).

Table 2 shows the comparison between Miss Universe Thailand and neoclassical canons and facial proportions. Nine points of facial analysis were statistically significant. Of 7 neoclassical canons, 6 were statistically significant. Of these, 3 facial proportions of Miss Universe Thailand were shorter than neoclassical canons: 2-section, nasofacial and orbital proportion canons. Three facial proportions of Miss Universe Thailand were longer than those of neoclassical canons: 4-section, orbitonasal and naso-oral proportion canons (Table 3).




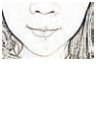


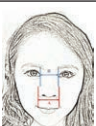


The nasofrontal angle, oral proportion, and chin projection were found to be statistically significant. Miss Universe Thailand group showed wider nasofrontal angle, thinner lower-upper lip height ratio, and less chin projection.

Table 4 shows the comparison between Miss Universe and neoclassical canons and facial proportions. Ten points of facial analysis were found to be statistically significant. Of 7 neoclassical canons, 6 were statistically significant. Of these, 3 facial proportions of Miss Universe were shorter than neoclassical canons: 2-section, 3-section, and nasofacial proportion canons. Three facial proportions of Miss Universe group were longer than those of neoclassical canons: 4-section, orbitonasal, and orbital proportion canons (Table 5).

The nasofrontal, nasofacial angle, nasal tip projection, and oral proportions were found to be statistically significant. Miss Universe group showed wider nasofrontal and nasofacial angle, more nasal tip projection, and thinner lower-upper lip height ratio.

Table 6 shows the comparisons between Miss Universe Thailand and Miss Universe groups, and 7 points of facial analysis were found to be statistically significant. Of the 7

Table 3. Facial Proportions between Miss Universe Thailand and Neoclassical Canons That Demonstrated Statistical Significance

Facial Proportions of Miss Universe Thailand Shorter than Neoclassical Canons	
	Two-section canon
	Nasofacial proportion canon 1) Lateral canthus to temporal: intermedial canthus 2) Eye width: interalar width
	Orbital proportion canon Eye width: intermedial canthus
	Oral proportion Lower lip: upper lip height
	Chin projection
Facial Proportions of Miss Universe Thailand Longer or Wider than Neoclassical Canons	
	Four-section canon
	Orbitonasal proportion canon Interalar: intermedial canthus
	Naso-oral proportion canon Oral width: intermedial limbus
	Nasofrontal angle

neoclassical canons, 5 were statistically significant: 2-section, 3-section, nasofacial, orbital and naso-oral proportion canons.

The 2-section, 3-section, nasofacial, and naso-oral proportion canons were longer in Miss Universe Thailand than in Miss Universe group. The nasofacial and orbital proportion canons were shorter in the Miss Universe Thailand than in Miss Universe group. Statistical significance was found in the nasal tip projection between Miss Universe Thailand and Miss Universe (Table 7).

Miss Universe Thailand had less nasal tip projection compared with Miss Universe. Eight points of facial proportion were not statistically significant between Miss Universe Thailand and Miss Universe groups, and of these, 4 facial proportions were not statistically significant with the neoclassical canons and previous facial proportion (oral width interalar width, nasolabial angle, tip to lip:lip to ala, and lower face proportion).

The other 4 facial proportions were statistically significant with the neoclassical canons and previous facial proportion (4-section canon, interalar: intermedial canthus, nasofrontal angle, and oral proportion).

Table 8 shows the comparison of the facial golden ratios between Miss Universe Thailand and Miss Universe groups. In the Miss Universe Thailand group, 12 facial ratios demonstrated statistical significance to the facial golden ratio. In the Miss Universe group, 12 facial ratios demonstrated statistical significance to the facial golden ratio. The gnathion-chelion:chelion-endocanthion, endocanthion-gnathion:endocanthion-chelion, labial superius-stomion:stomion-labial inferius did not demonstrate statistical significance in facial golden ratio in either group.

All horizontal facial golden ratios demonstrated statistical significance in both groups. In all 16 facial ratios,

Table 4. Facial Proportions of Miss Universe and Neoclassical Canons


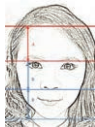



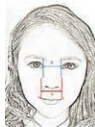




Facial Proportion	Description	Miss Universe* (n = 16)	Neoclassical Canons	P†
Two-section canon	Lower half: upper half	0.79±0.05	1	<0.001‡
Three-section canon	Middle part: upper part	0.88±0.07	1	<0.001‡
	Lower part: upper part	0.91±0.07	1	<0.001‡
Four-section canon	2 nd part: upper part	1.26±0.17	1	<0.001‡
	3 rd part: upper part	1.13±0.18	1	0.014‡
	4 th part: upper part	1.15±0.18	1	0.007‡
Nasofacial proportion canon	Lateral canthus to temporal: intermedial canthus	0.67±0.15	1	<0.001‡
	Eye width: interalar width	0.96±0.21	1	0.086
Orbitonasal proportion canon	Interalar: intermedial canthus	1.07±0.09	1	0.013‡
Orbital proportion canon	Eye width: intermedial canthus	1.07±0.12	1	0.045‡
Naso-oral proportion canon	Oral width: interalar width	1.52±0.18	1.5	0.488
	Oral width: intermedial limbus	1.05±0.09	1	0.057
Nasal proportion	Nasofrontal angle	138.58±9.31	125–135 degree	<0.001‡
	Nasofacial angle	43.79±8.17	35–40 degree	0.001‡
	Nasolabial angle	112.46±14.78	105–108 degree	0.071
Nasal tip projection	Ala to nasal tip: nasion to tip	0.73±0.10	0.67–1	0.029‡
	Nasal tip to lip: lip to ala	0.70±0.20	0.67–1	0.632
Lower face proportion	Stomion to gnathion: subnasale to stomion	2.05±0.42	2	0.629
Oral proportion	Lower lip: upper lip height	1.50±0.17	2	<0.001‡
Chin projection		11.69±4.47	11 degree	0.557

*Values are presented as mean ± SD.

†One-sample t test.

‡Statistically significant.

Table 5. Facial Proportions between Miss Universe and Neoclassical Canons That Demonstrated Statistical Significance

Facial Proportions of Miss Universe Shorter than Neoclassical Canons	
 Two-section canon	 Three-section canon
 Nasofacial proportion canon Lateral canthus to temporal: intermedial canthus	 Oral proportion Lower lip: upper lip height
Facial Proportions of Miss Universe Longer or Wider than Neoclassical Canons	
 Four-section canon	 Orbitonasal proportion canon Interalar: intermedial canthus
 Orbital proportion canon Eye width: intermedial canthus	 Nasofrontal angle
 Nasofacial angle	 Nasal tip projection Ala to nasal tip: nasion to tip

no statistical significance was found between the Miss Universe Thailand and Miss Universe groups (Table 9).

DISCUSSION

Human sculptures produced in ancient Greece were derived from proportions that followed established rules or “canons.”^{5,6} These rules were incorporated in the neoclassical canons for the human face by Renaissance artists such as Leonardo da Vinci, Vitruvius, Bergmuller, and Durer.^{7,8} Subsequently, these canons were adapted by medical artists, anatomists, and aesthetic surgeons, and are still being used to this day. Although neoclassical canons define the ideal face and are used for analyzing the attractive face, they were referenced from ideal, yet ancient, standards of beauty derived a small group of people and do not represent the majority.

Neoclassical canons were invalidated due to the differences in transcultural facial structures such as Chinese,⁵ Arabian,³ Turkish,¹⁰ Croatia,¹¹ Korean - American,¹² and Greek.¹³ However, neoclassical canons were more valid in whites than in Asians.^{7,12,14}

The esthetically attractive 1: 1.618 ratio, indicated by the Greek letter Phi (Φ), was first recorded in third century BC by the Pythagoreans. The facial golden ratio was shown by Ricketts¹⁵ in 1982.⁹ Surprisingly, only 10 frontal-view photographs (including 7 whites, 2 Asians, and 1 black) taken from magazine advertisements were analyzed.

The use of the golden ratio Phi mask for attractive facial measurement was revealed by Marquardt.¹⁶ The facial golden ratio and the Phi mask were used for identifying

Table 6. Facial Proportions of the Miss Universe Thailand and Miss Universe Groups






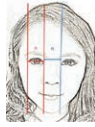

Facial Proportion	Description	Miss Universe Thailand* (n = 16)	Miss Universe* (n = 16)	P†
Two-section canon	Lower half: upper half	0.88±0.09	0.79±0.05	0.002‡
Three-section canon	Middle part: upper part	0.99±0.10	0.88±0.07	0.003‡
	Lower part: upper part	1.00±0.12	0.91±0.07	0.013‡
Four-section canon	2 nd part: upper part	1.20±0.26	1.26±0.17	0.432
	3 rd part: upper part	1.18±0.25	1.13±0.18	0.603
	4 th part: upper part	1.18±0.20	1.15±0.18	0.593
Nasofacial proportion canon	Lateral canthus to helix: intermedial canthus	0.87±0.23	0.67±0.15	0.008‡
	Eye width: interalar width	0.82±0.28	0.96±0.21	0.001‡
Orbitonasal proportion canon	Interalar: intermedial canthus	1.14±0.12	1.07±0.09	0.087
Orbital proportion canon	Eye width: intermedial canthus	0.93±0.12	1.07±0.12	0.004‡
Naso-oral proportion canon	Oral width: interalar width	1.47±0.20	1.52±0.18	0.756
	Oral width: intermedial limbus	1.17±0.14	1.05±0.09	0.011‡
Nasal proportion	Nasofrontal angle	142.82±12.46	138.58±9.31	0.300
	Nasofacial angle	39.76±9.64	43.79±8.17	0.227
	Nasolabial angle	104.57±6.31	112.46±14.78	0.068
Nasal tip projection	Ala to nasal tip: nasion to tip	0.63±0.15	0.73±0.10	0.037‡
	Nasal tip to lip: lip to ala	0.67±0.17	0.70±0.20	0.712
Lower face proportion	Stomion to gnathion: subnasale to stomion	2.10±0.35	2.05±0.42	0.740
Oral proportion	Lower lip: upper lip height	1.48±0.37	1.50±0.17	0.837
Chin projection		8.93±2.89	11.69±4.47	0.056

*Values are presented as mean ± SD.

†Mann-Whitney U test.

‡Statistically significant.

Table 7. Facial Proportions between Miss Universe and Miss Universe Thailand That Demonstrated Statistical Significance

Facial Proportions of Miss Universe Shorter than Miss Universe Thailand			
	Two-section canon		Three-section canon
	Nasofacial proportion canon Lateral canthus to temporal: inter-medial canthus		Naso-oral proportion canon Oral width: inter-medial limbus
Facial Proportions of Miss Universe Longer or Wider than Miss Universe Thailand			
	Nasofacial proportion canon Eye width: interalar width		Orbital proportion canon Eye width: inter-medial canthus
	Nasal tip projection Ala to nasal tip: nasion to tip		

the ideal face, and many studies demonstrated and supported this ratio.¹⁷⁻¹⁹

The invalidity of the facial Phi mask was shown^{2,20-26} including in Asians and whites. According to our results, the facial golden ratios were invalid in determining a beautiful face in the 21st century. Most of the facial ratios of Miss Universe and Miss Universe Thailand demonstrated statistically significant difference to the facial golden ratios.

Many studies have attempted to establish the modern facial proportions of beauty, using beautiful faces obtained from direct photographs, 3-dimensional scan and photographs from the internet,^{4,27-29} field of entertainment,^{4,29} magazines,³⁰ and beauty contests.^{26,31,32}

Pothanikat et al.³³ studied Asian female subjects and revealed that most attractive group had least convex face, larger forehead, and wider faces. Studies on Italian competitions in 2009 and 2010 were performed and compared with the normal population.^{31,34} Attractive women had more acute soft-tissue profile, increased upper facial width and middle facial depth, larger mouth, and more voluminous lips.

In Asia, studies were performed in Miss Korea 2012 competitions and compared with the normal population.^{26,32} The Miss Korea group showed greater total facial height and eye width, lesser lower-facial height, and more retruded and smaller lower lips and chins than the general population group. However, these studies did not describe the ranking of the participants who were analyzed in the studies.

Yehezkel and Turley³⁵ studied African American women in fashion magazines from 1940s through the 1990s.

Photographs were divided into 6 groups corresponding to the decade in which they were published. Significant between group differences were found for lip position, nasolabial angle, and interlabial angle, with increased fullness and more anteriorly positioned lips in the more recent decades. Esthetic standards for the African American female profile changed during the 20th century.

The study of Mommaerts and Moerenhout²⁸ on contemporary beautiful faces were retrieved from yearly polls of *People* magazine and *FHM*. The top 15 female faces were analyzed and compared with the pictures of classical sculptures. Their results showed harmonious contemporary faces had a significantly lower classical facial index, indicating that facial height was less or facial width was larger than in classical female faces.

Study of Iglesias-Linares et al.²⁷ in 2011 compared the most beautiful black and white people in the list of *People* magazine's 100 most beautiful people. Facial similarities in 2 ethnic groups were observed in the angle of the inferior facial third, labiomental angle, angle of facial convexity, cervicomental angle, and lower lip projection. They concluded that modern society was changing the classic concept of facial beauty because of globalization and prevalence of multiethnic communities in the developed world. Independent of ethnic origin, beautiful women tend to have similar facial features that were a mixture of both black and white features.

According to our results, the validity in the neoclassical canons was still demonstrated in oral width: alar width, nasolabial angle, nasal tip projection, and lower face proportion.





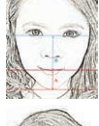






Moreover, the results showed that the facial golden ratio was not valid in modern beautiful women. Only 3 vertical ratios did not demonstrate statistical significance in both groups compared with the facial golden ratio (gnathion:chelion:chelion -endocanthion, endocanthion-gnathion:endocanthion -chelion, and labial superius-stomion:stomion-labial inferius). All horizontal ratios were shown to be different from the facial golden ratio in both Miss Universe Thailand and Miss Universe. Meanwhile, none of 16 facial ratios were statistically significant between the Miss Universe Thailand and Miss Universe groups.

Although Miss Universe Thailand did not win the Miss Universe contest between 2001 and 2015 and that Thai population is a small percentage of the world population, our results demonstrated that most of modern facial proportions of Miss Universe Thailand correspond with those of Miss Universe and are different from the Greek ideals of the neoclassical canons and the golden facial ratios.

Because variations in size of the photographs were a concern, only the proportions were studied. Anthropometric facial analysis is the study of the human face. Several indirect anthropometric methods exist, for example, cephalometry, photogrammetry, 3-dimensional stereophotogrammetry, and surface laser scanning. Of these methods, photogrammetry has advantages and is ideal for soft-tissue analysis. In addition, its reliability proved to be excellent and remains the optimal choice.³⁶⁻³⁸

The limitation of this study was the photographs were taken from the Internet that may be not truly anteropos-

Table 8. Vertical Facial Golden Ratios and Facial Proportion of the Miss Universe Thailand and Miss Universe Groups

Facial Proportion		Miss Universe Thailand*	P_{\dagger} (1: 1.618)	Miss Universe*	P_{\ddagger} (1: 1.618)	P_{\S}
1. zy-zy: tr-gn		1.382±0.095	<0.00001¶	1.329±0.086	<0.00001¶	0.1141
2. tr-en: en-gn		1.422±0.168	0.000774¶	1.453±0.095	2.2E-05¶	0.4777
3. gn-al: al-tr		1.715±0.161	0.03516¶	1.623±0.166	0.8977	0.09692
4. en-al: al-gn		1.366±0.167	4.4E-05¶	1.395±0.161	0.000105¶	0.57548
5. gn-ch: ch-en		1.549±0.237	0.280538	1.545±0.207	0.196558.	0.98404
6. ch-al: al-en		2.295±0.485	9.2E-05¶	2.015±0.243	1.8E-05¶	0.08544
7. al-ch: ch-gn		2.104±0.347	9.5E-05¶	2.054±0.423	0.001345¶	0.740
8. en-ch: en-gn		1.636±0.081	0.403918	1.643±0.076	0.217103	0.52218
9. en-al: en-ch		1.534±0.266	0.243288	1.445±0.095	<0.00001¶	0.30772
10. al-gn: en-gn		1.776±0.146	0.000904¶	1.709±0.097	0.002735¶	0.23014.
11. ls-sto: sto-li		1.721±0.295	0.193	1.72±0.246	0.137	0.98404

*Values are presented as mean ± SD.






†One-sample *t* test: between the Miss Universe Thailand group and the Phi ratio (1:1.618).

‡One-sample *t* test: between the Miss Universe group and the Phi ratio (1:1.618).

§Mann-Whitney *U* test: between the Miss Universe Thailand and the Miss Universe groups.

¶Statistically significant.

Table 9. Horizontal Facial Golden Ratios and Facial Proportion of the Miss Universe Thailand and Miss Universe Groups

Facial Proportion		Miss Universe Thailand*	P† (1: 1.618)	Miss Universe*	P‡ (1: 1.618)	P§
1. Intercanthal: intertemporal		1.337±0.071	<0.00001¶	1.297±0.059	<0.00001¶	0.10524
2. Interchilion: intercanthal		1.817±0.324	0.031996¶	1.939±0.155	<0.00001¶	0.05614
3. Interala: interchilion		1.474±0.168	0.005129¶	1.524±0.134	0.017519¶	0.756
4. Interdacryon: interala		1.138±0.123	<0.00001¶	1.068±0.092	<0.00001¶	0.087
5. Interdacryon: interchilion		1.800±0.306	0.037065¶	1.750±0.187	0.015627¶	0.75656

*Values are presented as mean ± SD.

†One-sample *t* test: between the Miss Universe Thailand group and the Phi ratio (1:1.618).

‡One-sample *t* test: between the Miss Universe group and the Phi ratio (1:1.618).

§Mann-Whitney *U* test: between the Miss Universe Thailand and the Miss Universe groups.

¶Statistically significant.

terior and lateral views. The focal lengths of the shots were not of the same length, which might have affected the proportions. This study represented only the early 21st century, and the facial ratios of beauty may change in the future.

CONCLUSIONS

The modern facial proportions of beauty are different from those of the past. Photogrammetric analysis demonstrated longer forehead, thinner lower-upper lip height proportion, wider interala-medial canthus width proportion, and wider nasofrontal angle compared with previous standards. Miss Universe winners showed wider nasofacial angle and more nasal tip projection than neoclassical canons. Moreover, the facial golden ratios were statistically significantly invalid in modern facial proportions of beauty. This is a retrospective study, and the results may be used as primary data when analyzing and planning for cosmetic surgery.

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REFERENCES

- Naini FB, Moss JP, Gill DS. The enigma of facial beauty: esthetics, proportions, deformity, and controversy. *Am J Orthod Dentofacial Orthop.* 2006;130:277–282.
- Veerala G, Gandikota CS, Yadagiri PK, et al. Marquardt’s facial golden decagon mask and its fitness with South Indian facial traits. *J Clin Diagn Res.* 2016;10:ZC49–ZC52.
- Al-Sebaei MO. The validity of three neo-classical facial canons in young adults originating from the Arabian Peninsula. *Head Face Med.* 2015;11:4.
- Rhee SC, Dhong ES, Yoon ES. Photogrammetric facial analysis of attractive Korean entertainers. *Aesthetic Plast Surg.* 2009;33:167–174.
- Ricketts RM. Divine proportion in facial esthetics. *Clin Plast Surg.* 1982;9:401–422.
- Jayaratne YS, Deutsch CK, McGrath CP, et al. Are neoclassical canons valid for southern Chinese faces? *PLoS One.* 2012;7:e52593.
- Edler RJ. Background considerations to facial aesthetics. *J Orthod.* 2001;28:159–168.

8. Le TT, Farkas LG, Ngim RC, et al. Proportionality in Asian and North American Caucasian faces using neoclassical facial canons as criteria. *Aesthetic Plast Surg.* 2002;26:64–69.
9. Farkas LG, Hreczko TA, Kolar JC, et al. Vertical and horizontal proportions of the face in young adult North American Caucasians: revision of neoclassical canons. *Plast Reconstr Surg.* 1985;75:328–338.
10. Karaca Saygili O, Cinar S, Gulcen B, et al. The validity of eight neoclassical facial canons in the Turkish adults. *Folia Morphol (Warsz).* 2016;75:512–517.
11. Pavlic A, Trinajstic Zrinski M, Katic V, et al. Neoclassical canons of facial beauty: do we see the deviations? *J Craniomaxillofac Surg.* 2017;45:741–747.
12. Choe KS, Sclafani AP, Litner JA, et al. The Korean American woman's face: anthropometric measurements and quantitative analysis of facial aesthetics. *Arch Facial Plast Surg.* 2004;6:244–252.
13. Zacharopoulos GV, Manios A, De Bree E, et al. Neoclassical facial canons in young adults. *J Craniofac Surg.* 2012;23:1693–1698.
14. Torsello F, Mirigliani L, D'Alessio R, et al. Do the neoclassical canons still describe the beauty of faces? An anthropometric study on 50 Caucasian models. *Prog Orthod.* 2010;11:13–19.
15. Ricketts RM. The biologic significance of the divine proportion and Fibonacci series. *Am J Orthod.* 1982;81:351–370.
16. Marquardt SR. Dr. Stephen R. Marquardt on the Golden Decagon and human facial beauty. Interview by Dr. Gottlieb. *J Clin Orthod.* 2002;36:339–347.
17. Kim YH. Easy facial analysis using the facial golden mask. *J Craniofac Surg.* 2007;18:643–649.
18. Bashour M. An objective system for measuring facial attractiveness. *Plast Reconstr Surg.* 2006;118:757–774; discussion 775.
19. Wiener RC, Wiener Pla RM. The occurrence of phi in dento-facial beauty of fine art from antiquity through the Renaissance. *Eur J Esthet Dent.* 2012;7:440–452.
20. Holland E. Marquardt's Phi mask: pitfalls of relying on fashion models and the golden ratio to describe a beautiful face. *Aesthetic Plast Surg.* 2008;32:200–208.
21. Kiekens RM, Kuijpers-Jagtman AM, van 't Hof MA, et al. Putative golden proportions as predictors of facial esthetics in adolescents. *Am J Orthod Dentofacial Orthop.* 2008;134:480–483.
22. Kiekens RM, Kuijpers-Jagtman AM, van 't Hof MA, et al. Facial esthetics in adolescents and its relationship to "ideal" ratios and angles. *Am J Orthod Dentofacial Orthop.* 2008;133:188.e1–188.e8.
23. Alam MK, Mohd Noor NF, Basri R, et al. Multiracial facial golden ratio and evaluation of facial appearance. *PLoS One.* 2015;10:e0142914.
24. Packiriswamy V, Kumar P, Rao M. Identification of facial shape by applying golden ratio to the facial measurements: an interracial study in Malaysian population. *N Am J Med Sci.* 2012;4:624–629.
25. Anand S, Tripathi S, Chopra A, et al. Vertical and horizontal proportions of the face and their correlation to phi among Indians in Moradabad population: a survey. *J Indian Prosthodont Soc.* 2015;15:125–130.
26. Jang KS, Bayome M, Park JH, et al. A three-dimensional photogrammetric analysis of the facial esthetics of the Miss Korea pageant contestants. *Korean J Orthod.* 2017;47:87–99.
27. Iglesias-Linares A, Yáñez-Vico RM, Moreno-Manteca B, et al. Common standards in facial esthetics: craniofacial analysis of most attractive black and white subjects according to People magazine during previous 10 years. *J Oral Maxillofac Surg.* 2011;69:e216–e224.
28. Mommaerts MY, Moerenhout BA. Ideal proportions in full face front view, contemporary versus antique. *J Craniomaxillofac Surg.* 2011;39:107–110.
29. Liew S, Wu WT, Chan HH, et al. Consensus on changing trends, attitudes, and concepts of Asian beauty. *Aesthetic Plast Surg.* 2016;40:193–201.
30. Milutinovic J, Zelic K, Nedeljkovic N. Evaluation of facial beauty using anthropometric proportions. *Scientific World J.* 2014;2014:428250.
31. Galantucci LM, Deli R, Laino A, et al. Three-dimensional anthropometric database of attractive Caucasian women: standards and comparisons. *J Craniofac Surg.* 2016;27:1884–1895.
32. Kim SY, Bayome M, Park JH, et al. Evaluation of the facial dimensions of young adult women with a preferred facial appearance. *Korean J Orthod.* 2015;45:253–260.
33. Pothanikat JJ, Balakrishna R, Mahendra P, et al. Two-dimensional morphometric analysis of young Asian females to determine attractiveness. *Ann Maxillofac Surg.* 2015;5:208–212.
34. Sforza C, Laino A, D'Alessio R, et al. Soft-tissue facial characteristics of attractive Italian women as compared to normal women. *Angle Orthod.* 2009;79:17–23.
35. Yehezkel S, Turley PK. Changes in the African American female profile as depicted in fashion magazines during the 20th century. *Am J Orthod Dentofacial Orthop.* 2004;125:407–417.
36. Brons S, van Beusichem ME, Bronkhorst EM, et al. Methods to quantify soft-tissue based facial growth and treatment outcomes in children: a systematic review. *PLoS One.* 2012;7:e41898.
37. Zhang X, Hans M, Graham G, et al. Correlations between cephalometric and facial photographic measurements of craniofacial form. *Am J Orthod Dentofacial Orthop.* 2007;131:67–71.
38. Wen YF, Wong HM, Lin R, et al. Inter-ethnic/racial facial variations: a systematic review and Bayesian meta-analysis of photogrammetric studies. *PLoS One.* 2015;10:e0134525.