

# Marquardt's Facial Golden Decagon Mask and Its Fitness with South Indian Facial Traits

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## ABSTRACT

**Introduction:** The mathematical ratio of 1:1.618 which is famously known as golden ratio seems to appear recurrently in beautiful things in nature as well as in other things that are seen as beautiful. Dr. Marquardt developed a facial golden mask that contains and includes all of the one-dimensional and two-dimensional geometric golden elements formed from the golden ratio and he claimed that beauty is universal, beautiful faces conforms to the facial golden mask regardless of sex and race.

**Aim:** The purpose of this study was to evaluate the goodness of fit of the golden facial mask with the South Indian facial traits.

**Materials and Methods:** A total of 150 subjects (75 males & 75 females) with attractive faces were selected with cephalometric orthodontic standards of a skeletal class I relation. The facial aesthetics was confirmed by the aesthetic evaluation of the

frontal photographs of the subjects by a panel of ten evaluators including five orthodontists and five maxillofacial surgeons. The well-proportioned photographs were superimposed with the Golden mask along the reference lines, to evaluate the goodness of fit.

**Results:** South Indian males and females invariably show a wider inter-zygomatic and inter-gonial width than the golden mask. Most of the South Indian females and males show decreased mid-facial height compared to the golden mask, while the total facial height is more or less equal to the golden mask.

**Conclusion:** Ethnic or individual discrepancies cannot be totally ignored as in our study the mask did not fit exactly with the South Indian facial traits but, the beauty ratios came closer to those of the mask. To overcome this difficulty, there is a need to develop variants of golden facial mask for different ethnic groups.

**Keywords:** Facial height, Golden ratio, Interzygomatic width, Intergonial width

## INTRODUCTION

Many artists and scientists have tried to understand or quantify the form of the perfect, ideal, or most beautiful face both in art and in vivo. A mathematical relationship has been consistently and repeatedly reported to be present in beautiful things. This particular relationship is the golden ratio. It is a mathematical ratio of 1:1.618 that seems to appear recurrently in beautiful things in nature as well as in other things that are seen as beautiful [1,2]. Dr. Marquardt developed a facial golden mask that contains and includes all of the one-dimensional and two-dimensional geometric golden elements formed from the golden ratio and he claimed that beauty is universal, beautiful faces conforms to the facial golden mask [3,4]. The judgment of facial attractiveness has been thought generally to be the product of individual taste, shaped in part by cultural and popular trends, and influenced by racial and sex differences in facial form [5]. Marquardt claims that golden mask fit to the beautiful faces irrespective of sex and race even though it was tailor made for Caucasian population.

## AIM

The purpose of this study was to evaluate the goodness of fit with the south Indian facial traits.

## MATERIALS AND METHODS

A sample of 150 individuals consisting of 75 males and 75 females between age group of 18 to 25 years with skeletal class I malocclusion were identified after initial screening of 280 patients reporting to the outpatient section of the Department of Orthodontics and Dentofacial Orthopedics at Panineeya Mahavidyalaya Institute

of Dental Sciences & Research Centre, Hyderabad, one of the biggest cosmopolitan cities in Southern India. The individuals were clinically selected based on the facial appraisal. The frontal at rest photographs and lateral cephalograms of the individuals were taken in the same institution with prior informed consent from the subjects.

## Inclusion criteria

1. Young adults between 18 to 25 years of age.
2. Skeletal class I malocclusion (confirmed by lateral cephalometric analysis) [Table/Fig-1].
3. Acceptable facial aesthetics with well-proportioned facial components (confirmed from subjective assessment by the panel judges).

Cephalometric Parameter	Normal range of value
ANB angle	2±2°
BETA angle	27-35°
Skeletal profile angle	0 ±5.1°
Soft tissue facial angle	97± 10°
Soft tissue profile angle	161°

[Table/Fig-1]: Inclusion criteria.

The facial aesthetics was confirmed by the aesthetic evaluation of the frontal photographs of the subjects by a panel of ten evaluators including five orthodontists and five maxillofacial surgeons. They were asked to rate the subject's face on a visual analogue scale (VAS) of five. Subjects with an average score of three or less than three were only included in the study [Table/Fig-2].

1	Very Good looking/ well-proportioned face	A beautiful face
2	Good looking/ proportioned face	An attractive face
3	Average/Acceptable	An average face
4	Below Average	An unattractive face
5	Poor/ Disharmonious	A very unattractive face

[Table/Fig-2]: Visual Analogue Scale (VAS)

**Exclusion Criteria**

1. Individuals with facial abnormalities and asymmetries.
2. Individuals with a class II and class III skeletal malocclusion.
3. Individuals with VAS(visual analogue scale) score greater than 3.

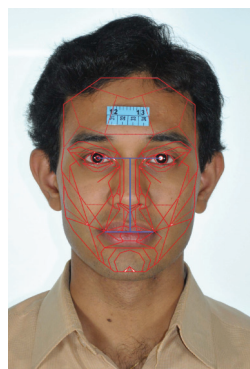
Standardized photographs of the 150 subjects (75 males and 75 females) were made ready by cropping the photographs to 4cm x 6cm size with sufficient margins surrounding the image in a uniform fashion. All the photographs were taken with a 40mm scale stuck on the forehead of the subjects to get 1:1 ratio during analysis. Adobe photoshop cs5 software was used for superimposition of the masks over subject photographs and the analysis was done. The three reference lines provided in the mask are:

1. Pupil line – Line connecting the center of right and left pupils
2. Lip line – Line connecting the right and left corners of the mouth
3. Facial vertical line – Line connecting the middle (or center) of pupil line with the middle (or center) of lip line.

All the photographs of the subjects were loaded in adobe photoshop cs5 software, male and female variants of Marquardt's golden decagon mask in GIF(*Graphics Interchange Format*) with three reference lines were superimposed on the male and female subjects standardized photographs respectively ensuring that both mask and photograph reference lines are coinciding with each other. Matching of the reference lines of the mask with the photographs was done by either enlarging or compressing the mask proportionately. All the superimposed photographs were saved in JPEG (Joint Photographic Experts Group) format which were used for further analysis. To calculate the difference, measurements of the photographs were compared to the measurement of the mask on the superimposed photographs. Transverse measurements included the inter-zygomatic width (Z-Z) and inter-gonial width (G-G) and vertical measurements included nasion to lip line (N-L) and the total facial height from nasion to menton(N-M) [Table/Fig-3,4].



[Table/Fig-3]: Standardised photograph, superimposed on photograph



[Table/Fig-4]: Golden mask

To explore the deviation of the South Indian population faces from the golden mask in transverse dimension, the Horizontal Ratios (HR) were obtained by dividing the interzygomatic and intergonial widths by the widths of those on the facial golden mask. The results are classified into three groups: Group 1 (HR<1) where

the subjects facial widths are narrower than those of the facial golden mask; Group 2 (HR=1) where the subjects facial widths are equal to those of the facial golden mask; Group3 (HR>1) where the subjects facial widths are wider than those of the facial golden mask.

In the same way Vertical Ratios (VR) were obtained by dividing the Nasion-Lip line length (N-L) and Nasion- Menton (N-M) lengths by the lengths of those on the facial golden mask. Then the results are classified into three groups: Group1 (VR<1) where the subjects facial heights are lesser than those of the facial golden mask; Group 2 (VR=1) where the subjects facial heights are equal to those of the facial golden mask; Group3 (VR>1) where the subjects facial heights are greater than those of the facial golden mask. [Table/ Fig-4,5] indicate the frequency distribution table of the groups for male and female subjects.

**RESULTS**

To assess the goodness of fit of the Marquardt golden mask with the South Indian faces, the differences between the photograph and the mask were calculated and paired t-test was done to evaluate statistically the significance of their difference. The difference was considered significant at p-value <0.001 [Table/Fig-5].

	Parameter	Photograph		Mask		Difference		p-value
		Mean	SD	Mean	SD	Mean	SD	
Male	Z-Z	138.41	6.18	135.38	6.40	3.03	4.75	<0.001***
	G-G	127.45	6.65	124.64	6.29	2.81	4.48	<0.001***
	N-L	66.41	4.13	72.85	3.59	-6.45	4.98	<0.001***
	N-M	111.07	4.80	112.46	5.42	-1.39	4.92	0.017*
Female	Z-Z	130.94	5.76	124.91	6.03	6.02	5.29	<0.001***
	G-G	115.46	5.86	101.32	5.43	14.14	5.46	<0.001***
	N-L	62.06	3.22	63.74	3.29	-1.69	3.09	<0.001***
	N-M	101.31	4.76	99.00	4.99	2.31	4.25	<0.001***

[Table/Fig-5]: Dimensions of the photograph and mask with p-value. \*Significant at p<0.05 \*\* Significant at p<0.01 \*\*\* Significant at p<0.001

The differences between the photograph and the mask for all the parameters for the female subjects were statistically significant indicating that Marquardt golden mask does not fit exactly with the South Indian females facial traits. For the male subjects, except the vertical facial height, all the other parameters show statistically significant difference between the face and mask at p-value <0.001.

			Group 1	Group 2	Group 3
1.	Z-Z	Frequency	6	5	64
		%	8.00%	6.67%	85.33%
2.	G-G	Frequency	0	1	74
		%	0	1.33%	98.67%
3.	N-L	Frequency	30	43	2
		%	40%	57.33%	2.67%
4.	N-M	Frequency	7	31	37
		%	9.33%	41.33%	49.33%

[Table/Fig-6]: Frequency distribution table of female subjects (n=75).

[Table/Fig-6] shows the distribution ratios for the female subjects. The horizontal ratios indicate that the South Indian females invariably show a wider inter-zygomatic (Z-Z) and inter-gonial (G-G) width than the golden mask. While the vertical ratios show a different perspective. The mid-facial (N-L) heights of the females are either equal or lesser than the golden mask measurements while the total facial (N-M) height is either more than or equal to

the golden mask. This indicates that South Indian females show a decrease in mid-facial height but the overall facial height is more, and this may be because of the increase in the lower facial height compared to the mid-face.

[Table/Fig-7] shows the distribution ratios for the male subjects. The horizontal ratios indicate that more than half of the South Indian males show a wider inter-zygomatic (Z-Z) and inter-gonial (G-G) widths compared to the golden mask and in the remaining half, more frequency of males shows almost equal dimensions to the golden mask. In the vertical dimension, most of the South Indian males show decreased mid-facial (N-L) height compared to the golden mask. Total facial (N-M) height of more than half of the subjects is equal to the golden mask. The other half of subjects show a greater tendency towards decreased total facial height compared to the golden mask.

			Group 1	Group 2	Group 3
1.	Z-Z	Frequency	10	22	43
		%	13.33%	29.33%	57.33%
2.	G-G	Frequency	10	24	41
		%	13.33%	32.00%	54.67%
3.	N-L	Frequency	58	16	1
		%	77.33%	21.33%	1.33%
4.	N-M	Frequency	26	39	10
		%	34.67%	52%	13.33%

[Table/Fig-7]: Frequency Distribution table of Male subjects (n=75).

## DISCUSSION

Marquardt golden mask was developed as one of the facial analysis methods so as to instantly recognize the balance and arrangements of facial structures [6]. Marquardt claimed that when photos of sculptures and portraits from ancient Greece to modern days were compared with the facial golden mask it was confirmed that beauty ratios came very close to those of the mask, regardless of time period or races [7].

There are some differences between the Asians and the westerners in their facial characteristics, in that the Asians have faces much wider than the mask whereas the westerners have faces a little wider than the facial golden mask. The fact that the Asians have wider faces has been confirmed in studies where the subjects were Chinese, Vietnamese, and Thais. Many studies conducted in recent years have confirmed the same fact [8-11]. Facial distribution of the Korean college students was studied by means of facial HRs (Horizontal Ratios), proving that the Korean college students have mid and lower faces wider than those of facial golden mask [12].

### Marquardt golden mask and South Indian facial traits

To evaluate the ethnic variations among the races and to determine the fitness of the Golden mask with the South Indian facial traits, the present study was conducted. The horizontal and the vertical ratios were calculated to assess the deviation based on which three groups were formed.

The horizontal ratios indicate that the South Indian females invariably show a wider inter-zygomatic (85.33% of female sample) and inter-gonial width (98.67% of female sample) than the golden mask. More than half of the South Indian males show a wider inter-zygomatic (57.33% of male sample) and inter-gonial widths (54.67% of male sample) compared to the golden mask and the remaining half of males shows almost equal dimensions to the golden mask. The above findings were consistent with the results of the previous studies where the facial widths of the Asian population are wider than those of the golden mask.

The mid-facial heights of the females are either equal (57.33% of female sample) or lesser (40% of the female sample) than the golden mask measurements while the total facial height is either more than (49.33% of the female sample) or equal (41.33% of the female sample) to the golden mask. This indicates that South Indian females show a decrease in mid-facial height but the overall facial height is more, and this may be because of the increase in the lower facial height compared to the mid-face.

Most of the South Indian males (77.33%) show decreased mid-facial height compared to the golden mask. Total facial height of more than half of the subjects (52%) is equal to the golden mask. The other half of subjects show a greater tendency towards decreased total facial height compared to the golden mask.

## LIMITATION

However the present study accomplished its aims and objectives, it has few limitations in selecting only the pleasing class-I profiles as subjects, this gives the scope for future studies where the different facial profiles can be examined for better understanding.

## CONCLUSION

Marquardt golden decagon mask does not fit exactly to the South Indian facial traits.

Most of the South Indian females and males show a wider inter-zygomatic and inter-gonial width and decreased mid facial height than the golden mask.

The golden mask can be used as one of the facial analysis methods so as to instantly recognize the balance and arrangement of facial structures at a glimpse and quite objectively as well on an aesthetic basis for the soft tissues rather than on the exact measurements.

It can be used in many different clinical situations in day to day practice including consultation with patients. Other merits are that it is economic to operate and data easy to store.

Though Marquardt claimed that the golden mask is a single universal standard for beauty regardless of race, age and sex. Ethnic or individual discrepancies cannot be totally ignored as in our study the mask did not fit exactly to the South Indian facial traits but, the beauty ratios came closer to those of the mask. To overcome this difficulty, there is a need to develop variants of golden facial mask for different ethnic groups.

## REFERENCES

- [1] Ricketts RM. The biologic significance of the divine proportion and Fibonacci series. *Am J Orthod.* 1982;81(5):351-70.
- [2] Peck S, Peck L. Selected aspects of the art and science of facial aesthetics. *Semin in Orthod.* 1995;1(2):105-26.
- [3] Marquardt SR. Dr Stephen R Marquardt on the golden decagon and human facial beauty. Interview by Gottlieb. *J Clin Orthod.* 2002;36(6):339-47.
- [4] Jefferson Y. Facial beauty—establishing a universal standard. *Int J Orthod.* 2004;15(1):9-22.
- [5] Naini FB, Moss JP, Gill DS. The enigma of facial beauty : aesthetics, proportions, deformity and controversy. *Am J Orthod Dentofacial Orthop.* 2006;130(3):277-82.
- [6] Kim YH. Easy facial analysis using the facial golden mask. *J Craniofac Surg.* 2007;18(3):643-49.
- [7] 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(2):200-08.
- [8] Lee JH, Kim TG, Park GW, Kim YH. Cumulative frequency distribution in east Asian facial widths using the golden mask. *J Craniofac Surg [Internet].* 2009;20(5):1378-82. doi: 10.1097/SCS.0b013e3181ae432a
- [9] Packiriswamy VK, 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(12):624-29.
- [10] Alam MK, Mohd Noor NF, Basri R, Yew TF, Wen TH. Multiracial facial golden ratio and evaluation of facial appearance. *PLoS One [Internet].* 2015;10(11):e0142914. doi:10.1371/journal.pone.0142914.eCollection2015.

- [11] Kusugal P, Ruttonji Z, Gowda R, Rajpurohit L, Lad P, Ritu. Three-dimensional facial analyses of Indian and Malaysian women. *Contemp Clin Dent*. 2015;6(3): 332-36.
- [12] Mizumoto Y, Deguchi T, Fong KWC. Assessment of facial golden proportions among young Japanese women. *Am J Orthod Dentofacial Orthop*. 2009;136(2): 168-72.

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