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Comparison of the golden proportion value between the width of maxillary central incisors with the innercanthal distance of Malaysian Indians using golden mean gauge

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Abstract
Maxillary central incisors plays an important role in dental aesthetic because it is the widest anterior teeth, have large proportion when compared with adjacent anterior teeth and supports lip position until loss of both maxillary central incisors may affects asthetic. Loss of anterior teeths will affect the distance of mesiodistal width of anterior teeths and will loss guideline from width of anterior teeths. Innercanthal distance can be use as a guideline to get the width of maxillary central incisors with golden proportion. In year 1978, Levin found concept of golden proportion, the ratio between the width of maxillary central incisors and innercanthal distance is 0.618. Proportion of the width of the maxillary central incisors and innercanthal distance are influenced by the race and gender. The purpose of this study is to get a value of the golden proportion between innercanthal distance and width of the maxillary central incisors in Malaysian Indians aged 21-25 years. The study used a descriptive analytic method with cross-sectional design. The method of this study is the manufacture of study model with gypsum type IV from each subject. In the study model, the maxillary central incisors were measured at the most marginal ridge width from the right distal to the left of the teeth. Innercanthal distance measured from the inner corner of the left eye to the right. Measurements were made using golden mean gauge and digital calipers. The result shows the value of the golden proportion between innercanthal distance and maxillary central incisors in Malaysian Indians aged 21-25 years was 0.558 ± 0.021 and there is no significant relation value of the golden proportion between innercanthal distance and width of the maxillary central incisors between different sex and age. In summary, the value of the golden proportion between innercanthal distance and maxillary central incisors in Malaysian Indians aged 21-25 years was smaller than concept of the golden proportion 0.618.

Keywords: Innercanthal distance, width of maxillary central incisor, golden proportion

1. Introduction
Facial aesthetics is a concept related to beauty or an attractive face and it become one of the important thing in life. An important factor that determining facial aesthetic is based on the tooth appearance which create a beautiful smile [1].
Maxillary central incisor is the widest tooth among other anterior teeth. Loss of maxillary central incisor width affects arrangement of other anterior teeth and may affect the function of aesthetics. As a result, dentist requires a guideline to reform width of both maxillary central incisors [2]. Various guidelines have been suggested and reported that all of them can be used to estimate width of both maxillary central incisors to the patients such as interpupillary distance, intercommisural width, innercanthal distance, interalar width and bizigomatic width [3]. One of the facial antropometric measurement is the distance between inner canthus of the eyes. Innercanthal is corner of eye where the upper and lower eyelids meet. The innercanthal distance is defined as the distance between the medial angles of the palpebral fissure [4]. Normal innercanthal distance is from 28mm to 35mm because its influenced by the shape of face, race and gender [5].
Innercanthal distance is used as a guideline to get the width of both maxillary incisors teeth to form perfect arrangement of teeth. Rule of fifth is called as vertical fifth where all five parts are same as the width of eye. Based on this concept, innercanthal distance is same axis with the width of maxillary anterior teeth. This shows that innercanthal distance can be used as a guideline for the selection of maxillary anterior teeth [6].

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Golden proportion is an aesthetic concept that can create harmonious anterior teeth. Many studies have been done using innercanthal distance to get a suitable value of golden proportion for the width of both maxillary central incisors according to race and gender. Lombardi was the first person who suggest the use of the concept of golden proportion in dentistry. In 1978, Levin had found a mathematical constant that describes the ratio between the proportion of the smallest to the greatest to the whole is 0,618 : 1 and the ratio is called as golden proportion.[3] According to the research of Bali *et al*. (2013) and also George S *et al*. (2010) in India states that value of golden proportion for Indians is 0,618 where the width of both maxillary central incisors were obtained from the formula (value of golden proportion x innercanthal distance) [2, 3]. This shows that ratio between both of maxillary central incisors with innercanthal distance is 0,618 : 1 [3].

Factors that may affect the width of both maxillary central insicors and innercanthal distance are race, gender and age. Caucasians have smaller anterior tooth size when compared with mongoloids [7]. Reddy *et al*. (2014) stated that width of both maxillary central incisors were larger in male when compared to female [8]. LeTT *et al*. (2002) states that face profile for each race is different and face profile is the dominant characteristics in Asian community because innercanthal distance is wider when compared with caucasians [9]. Kumar *et al*. (2014) stated that average value of innercanthal distance in male is greater when compared to female [10]. Maxillary central incisors erupt completely at the age of 10 years. After the eruption of teeth complete, the bone growth also will completed. This underlines me to examine the age of 21-25 years because the growth and development of teeth will be completed at the age of 18 years.

Research on the golden proportion between the width of both maxillary central incisors with innercanthal distance has never been done to the Malaysian Indians. Based on that, the researcher was interested to do research on the concept of golden proportion between innercanthal distance and both maxillary central incisors in Malaysian Indians population aged of 21-25 years.

2. Materials and Method
This study used a descriptive analytic method with cross sectional design that collects data of innercanthal distance and width of both maxillary central incisors of Malaysian Indians who aged of 21-25 years to analyse the value of the golden proportion.

Golden mean gauge (Figure 1) and digital caliper were used for the measurements.

Fig 1: *Golden mean gauge*[11]

The study was conducted on Malaysian Indians students of Dental Faculty. Subjects were selected according to the inclusion and exclusion criteria. The inclusion criterias were Malaysian Indians of two generations, male and female aged of 21-25 years and Class I occlusion. Subjects with caries, restorations, erosion, congenital facial defects, orbital disease, orthodontic or crown restorations were excluded.

Impression of maxilla is taken using alginate from the subject and filled it with dental stone. Once its hardened, the model is coded. In the model, mark the points that needed to be measured using pencil. The greater width of marginal ridge from right distal tooth to the left distal tooth of maxillary central incisor were measured using golden mean gauge (Figure 2). The width from the golden mean gauge is measured using digital caliper for an accurate result.

Fig 2: Measurement of maxillary central incisors using golden mean gauge

Subjects were instructed to sit on a chair and close their eyes. Innercanthal in both eyes were marked using eyeliner. Innercanthal distance were measured from the inner corner of the left eye to the right eye using golden mean gauge (Figure 3). Golden mean gauge placed on paper and carefully marked and measured by caliper digital. The measurements were done by three operators.

Fig 3: Measurement of innercanthal distance using golden mean gauge

3. Results
The mean value of the width of both maxillary central incisors was 17,502 ± 0,817 mm, the mean value of innercanthal distance was 31,347 ± 1,333 mm, and mean value of golden proportion between innercanthal distance and width of both maxillary central incisors was 0,558 ± 0,021 (Table 1).

Table 1: Mean value of the width of both maxillary central incisors, innercanthal distance and golden proportion between innercanthal distance and width of both maxillary central incisors

Variabel	Mean ± SD
Width of both maxillary central incisors (mm)	17,502± 0,817
innercanthal distance (mm)	31,347 ± 1,333
Value of golden proportion between innercanthal distance and width of both maxillary central incisors	0,558 ± 0,021

Based on the measurements, average mean value of golden proportion for Malaysian Indians and the golden mean gauge is shown in table 2.

Table 2: Average mean value of golden proportion for Malaysian Indians and the golden mean gauge

Golden proportion	Mean ± SD	P
Malaysian Indians	0,558 ± 0,021	0,000*
Golden mean gauge	0,618 ± 0	

Uji Independent T-Test, *significant *p*<0,05

4. Discussion

The result of this study (Table 1) shows that the mean value of the width of both maxillary central incisors of Malaysian Indians was 17,502 ± 0,817 mm. Ahmed *et al.* (2015) obtained mean value of the width of both maxillary central incisors was 15,90 ± 1,36 mm. Result of this study shows greater value of the width of both maxillary central incisors when compared with Ahmed *et al.* (2015). Race of subjects used in both studies are same but ethinics are different. Ethnic of this study was Indians while in the research of Ahmed *et al.* (2015) was Pakistani [12]. Teeths that had grown completely cannot changed in size and width of teeth are not influenced by nutrition, and only can be affected at the time of eruption. Genetic factor can affect the calcification of tooth, shape of corona and composition of mineral in the process of growth and development of teeth. Environmental factor such as diet, nutrition, radiation, chemical or andocrine abnormalities also can affect the mesial distal if tooth size [13, 14].

The result of this study (Table 1) shows the average value of innercanthal distance of Malaysian Indians was 31.347 ± 1.333 mm. Egwu *et al.* (2008) had a mean value of innercanthal distance was 42.99 ± 0.39 for the population of Nigeria. Results of this study shows smaller innercanthal distance value when compared with the research of Egwu *et al.* (2008). Race of Malaysian Indians is Caucasian while samples of Egwu *et al.* (2008) are from negroid [15]. Caucasian has a straight face with a narrow and tower shaped nasal bone. Negroid has a prominent or prognatic face profile with wider and metal dome shaped nasal bone [14]. This shows the innercanthal distance of Malaysian Indian who are Caucasian are smaller when compared with the negroid [16].

The result of this study (Table 1) shows the average value of the golden proportion between the innercanthal distance and the width of both maxillary central incisors was 0.558 ± 0.021. Based on theory and the research of George *et al.* (2010) and Bali *et al.* (2013), the value of the golden proportion is equals to 0.618. The result of this study were smaller when compared with studies of George *et al.* (2010) and Bali *et al.* (2013). This is because there is a difference between the mean value of innercanthal distance and width of both maxillary central incisors of Malaysian Indias. In addition, this study was conducted in Malaysian Indians while research of George *et al.* (2010) and Bali *et al.* (2013) was conducted in Indian who lives in India [2, 3].

Based on the result of the study (Table 2) shows the average value of the golden proportion of the Malaysian Indians were 0.558 ± 0.021 and the golden mean gauge were 0.6180 ± 0. Based on Independent T-Test shows that there are significant differences ($p<0.05$) between the value of the golden proportion in Malaysian India and the golden mean gauge tool, where the value of the golden proportion in Malaysian Indians were smaller. This is because the value of the width of both maxillary central incisors are larger and the innercanthal distance are smaller when compared to the golden mean gauge and the value of the golden proportion become smaller for the Malaysian Indians.

5. Conclusion

The average value of the width of both maxillary central incisors for Malaysian Indians aged 21-25 years was 17.502 ± 0.817 mm, the average value of the innercanthal distance was 31.347 ± 1.333 mm, and the mean value of the golden proportion between the innercanthal distance and the width of the both maxillary central incisor was 0.558 ± 0.021. There are significant differences between the value of the golden proportion of Mlaysian Indians and the golden mean gauge ($p<0.05$)

6. References

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