ORIGINAL ARTICLE

Facial profile analysis by photometry among elementary school students: an observational analytic study

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ABSTRACT

Introduction: The facial profile refers to the anteroposterior relationship visible from the lateral view of the face. There are three types of the facial profile: straight, convex, and concave. Photometry is a reliable, simple and accurate methods for determining the facial profile. Facial profile can be influenced by various factors, such as genetics, gender, age, and environment. This study aims to analyze the differences in facial profiles between male and female elementary school students. **Methods**: an observational analytic with a cross-sectional design. The subjects were elementary school students in Jember Regency, aged 6-12 years. A of 141 children participated in the study, consisting of 76 males and 65 females. Data analysis included Kolmogorov-Smirnov normality test, the Levene test for homogeneity, and an independent parametric t-Test to compare the facial profiles of males and females. **Results**: The average facial profile angle among elementary school students shows a straight facial profile. The average angle for females was 157.71º, which was slightly greater than that of males. However, there was no significant difference between male and female facial profiles. Similarly, no significant difference observed between the facial profiles of students aged 6-9 years old and those aged 10-12 years old. **Conclusion**: Elementary school students predominantly exhibit straight facial profiles, with this profile being more common among males.

KEYWORDS

Facial profile, photometry, gender, age, genetic

INTRODUCTION

Facial examination is an important component in determining an orthodontic treatment plan. This objective evaluation includes head shape, face type, and facial profile. Assessing the facial profile in orthodontics significantly influences diagnosis, treatment planning, and the overall treatment approach. Incorporating facial aesthetics into the assessment is believed to be essential for achieving an accurate diagnosis and effective treatment planning.[1] A previous study revealed

that there is a relationship between facial features, cranial structure, and occlusal changes in malocclusion, indicating that information about the skull and dental abnormalities can be identified from facial profile images.[2]

Several methods have been developed to determine the facial profile, including radiographic cephalometry and photometry.[3] Photometry in dentistry involves the use of light measurement to assess and evaluate dental aesthetics. It is a proven, reliable, easy, and accurate method. In addition, photometry serves as an alternative assessment tool when cephalometric analysis is unavailable.[4] Extraoral photometry is performed by capturing profile images with the head positioned parallel to the floor, followed by calculating the angle using the G-Sn-Pog landmark.[5]

A facial profile refers to an anteroposterior relationship that can be evaluated from a lateral view of the face. It is categorized into three types: straight, convex, and concave. A straight profile is when the Glabella, Subnasal, and Pogonion points align in a straight line. In a concave profile, the Pogonion point is positioned more anteriorly, while in the convex profile the Pogonion point is located more posteriorly.[6,7]

The facial profile significantly affects an individual's self-esteem and self-image, which are closely related to their quality of life. However, facial beauty standards vary widely and are influenced by the social environment. Various factors may affect the facial profile, including genetics, gender, age and environment.[1] Growth differences in males and females can result from natural or confounding factors.[8] Natural factors include genetic variations and biomechanical stresses or theories, while confounding factors include malnutrition, hormones and habitual behaviors.[9] Genetic variation plays a key role in regulating the growth of the upper and lower jaw. According to biomechanical theory, the main factor in controlling bone growth is pressure. Mechanical stress is one of the critical signals in osteogenic activation within connective tissue.[10]

Gender is one of the factors that influence the facial profile.[11] Females experience a growth spurt approximately two years earlier than the males, resulting in slower skeletal maturation rate in males. Consequently, the most significant changes occur earlier in females compared to males.[12] .[13] Age is also cosely related to the rate of craniofacial growth.[14] Growth is typically completed around the eruption of the second molar teeth, at approximately 12 years of age. By this age, males reach 95% of their adult maxillary size, while females reach 98%.[15] The subjects in this study were students aged 6-12 years from Candijati 1 Elementary School in Jember.

The description above is the reason the author is interested in conducting research to analyze the facial profiles of students using the photometry method. This study aims to analyze the differences of facial profile between male and female elementary school students

METHODS

This was observational descriptive study with a cross-sectional design. The population of interest was students of Candijati 1 Elementary School in Jember Regency who were present during the study and met the sample criteria. The sample size of this study was 141 children, consisting of 76 male students and 65 female students. The sample size in this study was determined through total sampling, amounting to 141 children, consisting of 76 male students and 65 female students. The minimum sample size, calculated using Slovin formula, was 59.

The students were briefed about the study and requested to sign informed consent. The subjects were asked to sit with a neutral head position or parallel to the floor, and the photo was taken. After photo acquisition for all subjects was completed, editing was carried out by marking the Glabella-Subnasal-Pogonion points using *Corel Draw* software.

Data were obtained by connecting the landmark points, and the angle calculation in each photo was measured using *ImageJ.* The data were categorized into straight, convex, or concave facial profile types. The data were then analyzed using the Kolmogorov-Smirnov normality test and Levene's homogeneity test, and were further analyzed using the parametric independent T-test (results is in Table 2).

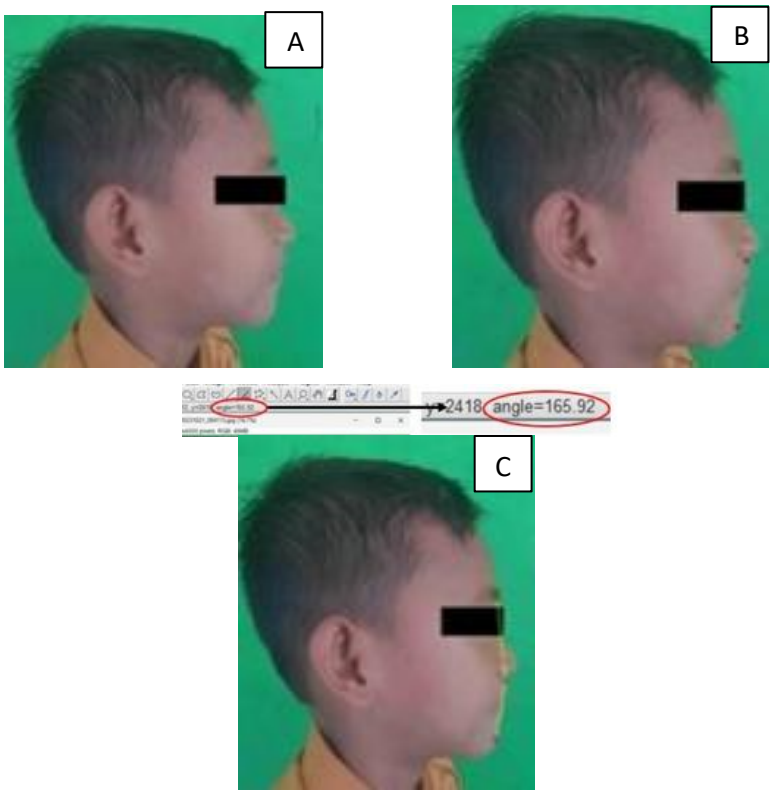

Figure 1. A Lateral photography of the subject B Pointing landmarks using *CorelDraw* C Angle measurement using *ImageJ*.

RESULTS

The results of the study showed that 52 males and 43 females have a straight facial profile, followed by a convex facial profile in 13 males and 11 females. Concave facial profiles were equally distributed between female and male students, with 11 students in each group. Regarding age-based analysis, straight facial profiles were more prevalent in males aged 10-12 years. Concave facial profiles were more common in the age range of 6-9 years old. Convex facial profiles share similar distribution among males aged 6-9 and 10-12 years. Females aged 6-9 years had a greater percentage of straight facial profiles, while those aged 10-12 years had a greater percentage of concave and convex facial profiles.

Table 1. Distribution of facial profiles by gender and age at Candijati 1 Elementary School Jember Regency

Gender	Age	Percentage of Face Profile Types		
		Straight	Concave	Convex
Male		52	11	13
	6-9 year	63%	20%	17%
	10-12 year	74%	9%	17%
Female		43	11	11
	6-9 year	78%	13%	9%
	10-12 year	55%	21%	24%

The results of the study indicated that the average angle of the facial profile of Elementary School students was 154.25º for males and 157.71º for females.

Straight facial profiles in males with angles between 145.12º-161.86º and in females with angles between 149.10º and 165.29º.[15] These results suggest that the average facial profile of Elementary School students is straight.

Table 2. The results of the mean difference test of facial profile angles with the Independent T-test on students of SDN Candijati 1, Jember Regency

Gender	Total	Average	*P**
Male	76	154.25.º	0.085
Female	65	157.71.º	0.085

*p**: significance level using Independent T-test

DISCUSSION

Based on Table 1, this study reported that straight facial profiles have a greater percentage than convex and concave facial profiles. This finding aligns with the understanding thatfacial growth tends to stabilize between the age of 6 and 12 years. During this period, growth in the forehead, nose, and chin area is relatively stable.[14] A straight facial profile can also indicate a Class 1 skeletal malocclusion pattern.[16]

The convex facial profile in males between the age of 6-9 years and 10-12 years is similar, while in females the percentage of convex facial profiles is higher at the age of 10-12 years. This is due to the peak of female growth occurring at this age, therefore craniofacial growth has increased convexity.[16] The presence of a concave profile in this study is associated with Class III malocclusion.

The Class III skeletal malocclusion pattern is characterized by a concave profile that can occur due to mandibular protrusion, maxillary retraction, or a combination of both.[17] Rahimah (2023) states that a concave facial profile can occur with a very small difference in measurement angle from the normal angle because the accumulation of fat on the chin can make the patient's jawbone appear too forward, resembling a Class III malocclusion.[1]

Table 2 showed that the average angle of the female face profile is greater (157.71º) than that of males (154.25º). This different of angle measurement can be attributed to the absence of significant facial contour protrusion in females compared to males. Consequently, the growth of facial profiles tends to be straighter in males than in females.[7] The results of this study are comparable with the study conducted by Dominique & Nofrizal (2023), which stated that chin growth in males contributes to a straighter facial profile compared to females.[18]

The results of the study are in line with the findings of Bannister (2022), who reported that the average female face tends to be smaller in the eyebrows and nose, with a less prominent chin compared to the male face.[19] These results are also consistent with study conducted by Skomina (2020), which indicated that female faces are typically rounder and smaller, while male faces have larger noses and more prominent lower foreheads.[20] Furthermore, the findings are in line with Lesilolo et al. (2022), who reported that girls have smaller soft tissue dimensions compared to boys.[16]

Skomina (2020) states that as age increases, the facial profile in males tends to become straighter, while in females, straight facial profile are more prevalent at the age of 6-9 years. This is because the mandibular growth of girls tends to stabilize at this age and changes as they approach puberty.[20,21] The results showed that straight facial profiles were more common in males aged 10-12 years compared to those aged 6-9 years.

No significant difference in facial profiles between males and females was observed in this study, likely due to the small difference in the average value of the angles of male and female facial profiles. This result is comparable to the study by Alhazmi et al. (2023), which also found no significant difference in facial profile between the two genders.[22] Additionally, another study conducted by Jae-Young

(2022) confirmed that there was no significant difference in facial profile curvature between men and women.[23]

The results of this study which showed no significant differences in facial profiles between children aged 6-9 years and 10-12 years, can be attributed to the fact that the children in this study were within the Elementary School age range. This is consistent with research by Yunaini & Arnidha (2020), which suggests that physical growth and development during this period is slower or more stable compared to the childhood and puberty. [24] However, it is important to note that this does not indicate that children's development has stopped.

The facial profile of Elementary School students tends to be straight, with a slightly higher prevalence in male students compared to female students. A limitation of the study was instability of the chin support, which could have affected the accuracy of maintaining the subjects' neutral head position. For future research, it is recommended to use a more stable chin support to improve measurement accuracy.

This study provides valuable data on the facial profiles of students of Candijati 1 Elementary School in Jember Regency, aged 6-9 years and 10-12 years. The measurements obtained in this study can serve as important parameters for facial assessment, supporting in evaluation, diagnosis, and treatment planning, especially for malocclusion cases.

However, a limitation of this research is the absence of a study model, which would have allowed for the assessment of upper and molar relationship and provided a more comprehensive understanding of occlusion classification (Class I, II, or III).

CONCLUSION

Students at Candijati 1 Elementary School in Jember Regency predominantly exhibit a straight facial profile. However, this profile is less common in female compared to male students. A potential implication of this finding that the absence of significant facial contour protrusion on the contours in females, compared to males, may contribute to the straighter facial profiles growth observed in males.

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