Concurrence Between the Maxillary Midline and Bisector to the Interpupillary Line

EVANIA ESKELSEN, DDS, MSc*
CAMILA BORGES FERNANDES, DDS, MSc*
FERNANDA PELOGIA, DDS, MSc†
LEONARDO GONÇALVES CUNHA, DDS, MSc, PHD‡
DÉBORA PALLOS, DDS, MSc, PHD‡
MAXIMILIANO PIERO NEISSER, DDS, MSc, PHD‡
PRISCILA CHRISTIANE SUZY LIPORONI, DDS, MSc, PHD‡

ABSTRACT

Purpose: Symmetry is one of the factors that contributes to facial harmony, and in oral rehabilitation it determines the success of esthetic treatment. Therefore, the aim of the present study was to analyze the axial symmetry between the bipupillar midline and maxillary central incisors midline of 102 dental students (both genders) distributed across five Brazilian dental schools.

Materials and Methods: Students with no teeth missing and who had never been subjected to any dental treatment were selected. Photographs were taken with a Dental Eye III camera with a 100-mm macro objective and ratio of 1 : 10 from natural size, recorded on an Ektachrome ASA/ISO 100 film. The images were developed and applied to Microsoft Office Power Point 2007 software. The results were analyzed by analysis of variance and Student's *t*-test ($\alpha = 0.05$).

Results: There was no significant correlation between bipupillar midline and the maxillary dental midline, irrespective of gender.

Conclusion: No significant coincidence was observed between the interpupillary and dental midline. However, the interpupillar distance and its relationship with other anatomic structures may be used as a reference in treatment, but measurements must be assessed individually.

CLINICAL SIGNIFICANCE

Anatomic measurements and facial proportions can be helpful during the planning of esthetic oral rehabilitation.

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INTRODUCTION

Facial symmetry is usually considered an important component of a harmonious smile.[1] Esthetic appearance is intensified when the maxillary midline coincides with the midline of the face.[2] Even if no scientific basis exists to justify this statement, the

*Doctoral student, Department of Dentistry, University of Taubate, Taubate, SP, Brazil
†Doctoral student, Department of Dental Materials and Prosthodontics, University of the State of Sao Paulo, Sao Jose dos Campos, Brazil
‡Associate professor, Department of Dentistry, University of Taubate, Taubate, SP, Brazil

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coincidence of both lines is recognized by the patients.[3]

It is recommended that the mesial surface of maxillary central incisors be in contact with an imaginary vertical line that bisects the face.[3] The midpoint of the interpupillary line, or the line from the center of the brows, is typically used to locate the facial midline.[2]

The interrelationship of the components of the face, such as the nose, eyes, lips, and chin, in harmonious or symmetrical proportion is one of the factors that contributes to facial harmony.[1,4,5] Its application in restorative and/or rehabilitating procedures can determine the esthetic success of treatment.[6]

Various anatomic measurements have been proposed to help planning orthodontic, prosthetic, or restorative treatments, with the objective of achieving a pleasant esthetic appearance.[7] Among these are the bipupillar distance and determination of the midline. Patients that present greater deviations in the interrelation of these lines can be considered less attractive from an esthetic standpoint.[8]

Therefore, the aim of the present study was to analyze axial facial symmetry, comparing the perpendicular midline bisector of the bipupillar distance with the maxillary midline.

MATERIALS AND METHODS

Determining the Number of Samples

As an initial step, a pilot study was conducted to calculate the sample size. For this purpose, 10 photographs were analyzed, and, based on the measurements obtained, the calculation was established. With the help of the software Bio Estat 4.0 (IDSM, Belém do Pará, Brazil), with statistical significance of 95% and power of 90%, the Student's statistical *t*-test for a single sample was applied and thus $N = 102$ samples was established. For sample selection at the different universities, a simple randomization was applied, also with the help of the Bio Estat 4.0 software.

Sample Selection

One hundred and two students from five Dental Schools, of both genders, from different Brazilian universities participated in the present study. They all signed a document of free and informed consent to participate in the research and granted the right to use their images. Those that presented partial or complete absence of teeth, periodontal disease, restorations, artificial crowns, and history of orthodontic and/or orthopedic appliance use, congenital facial anomalies, or facial surgery were excluded from the study.

Obtaining Images

Each individual was positioned with the Frankfurt plane parallel to the ground. They were photographed smiling, aiming to expose the central incisors. Photographs were taken with a camera Dental Eye III (Yashica-Kyocera Optics Inc, Somerset, NJ, USA), with a 100-mm macro objective and a ratio of 1 : 10 from natural size, recorded on a 35-mm film (Ektachrome ASA/ISO 100—Kodak Inc, São José dos Campos, São Paulo, Brazil), and whose negatives, after being processed by the same commercial laboratory, were digitized to generate files with $1{,}840 \times 1{,}232$ pixels, in JPEG format.

Image Analyses

The images were inserted in a Microsoft Office Power Point 2007 software (Microsoft Corp., Redmond, WA, USA), and, using the line tool, two lines were traced: line A, horizontal, from pupil to pupil; and line B, perpendicular and median to line A. The images were aligned with the interpupillar line and magnified 3× in order to enable the center of the pupil to be marked with precision. The distance between them was determined. A vertical line was traced on the perpendicular midline

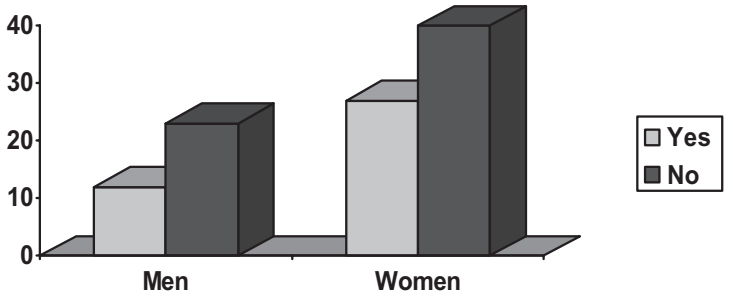

Figure 1. Distribution of the results in relation to gender.

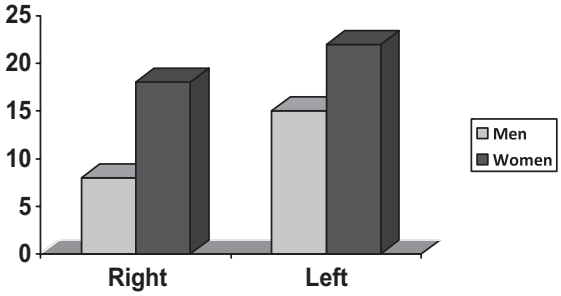

Figure 2. Direction of displacement of the median line.

TABLE 1. NUMERICAL DISTRIBUTION OF THE RESULTS OBSERVED.

Groups	Number of samples (*N*)	Gender	Quantity (*N*) in each group	Direction of displacement
YES	39 *	Men	12	
		Women	27	
NO	63	Men	23	Right 8 *
				Left 15
		Women	40	Right 18
				Left 22

*Statistically significant difference—the origin of the arrow indicates the highest value.

bisector of line A in order to observe whether there was coincidence with the mesial surface of the central incisors.

Analysis of the axial symmetry related to the bipupillar perpendicular midline bisector was performed, classifying the cases of coincidence as Yes (group Y) and the others as No (group N) (Figure 1). Group N was submitted to secondary analysis in which the direction of displacement of the median line (Figure 2) was assessed.

The results were analyzed by one-way analysis of variance and Tukey's test at a significance level of 5%.

RESULTS

Statistical analysis showed a significant difference between the groups Y ($N = 39$) and N ($N = 63$) (Table 1), evidencing that there was no coincidence between the maxillary midline and the perpendicular bisector of the interpupillar distance. Analyzing the two groups with regard to gender, there was no statistically significant difference between men and women samples for both groups.

For group N, the males presented a statistically significant difference in the direction of the deviation of the line, showing the deviation to the left to be more frequent. When the same assessment was made for the females, no difference was observed (Table 1).

DISCUSSION

Measurements and proportions can be used in order to assess anatomical distances. However, it should

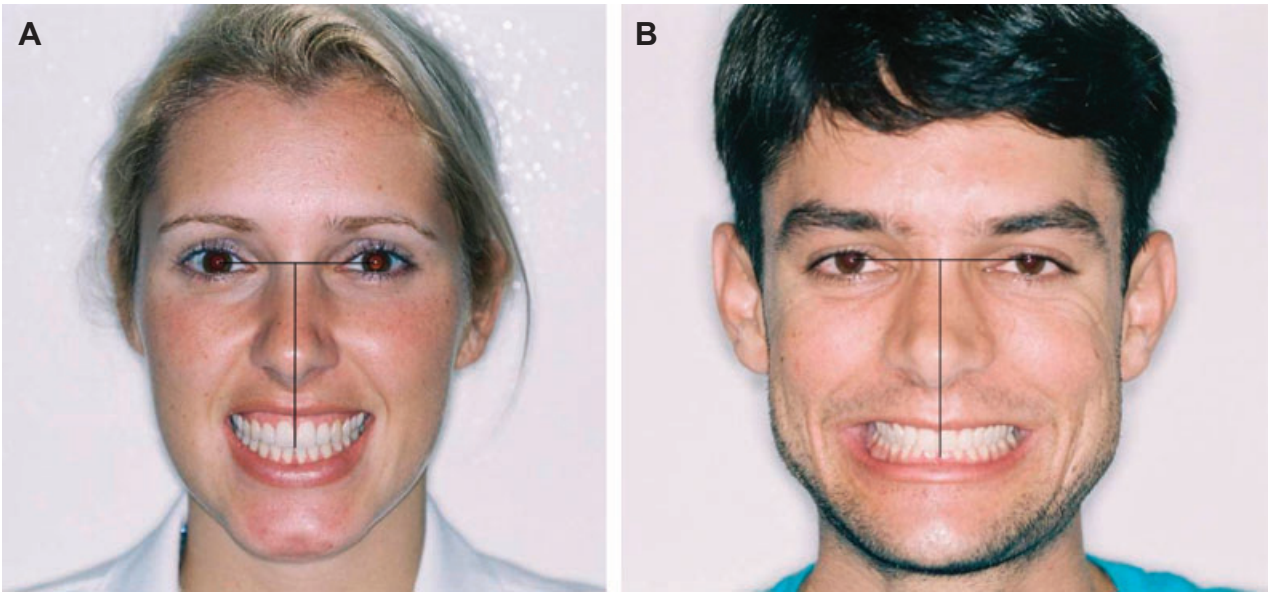

*Figure 3. Coincidence (*A*) or absence of coincidence (*B*) between bipupillar bisector line and dental midline.*

be pointed out that patients must be compared with their own norms of age, gender, and race to assess deviations from normality.[9] The interpupillary distance and its relationship with other anatomic structures can be used as a reference in treatments, but measurements must be assessed individually,[10] because facial harmony features include facial height, facial shape, facial profile, gender, and age.[6]

A previous work from Golub[11] showed that the dental midline, perpendicular to the interpupillary line, offers one of the most striking contrasts serving to anchor the smile of the face (Figure 3A). However, in the present study, it was noted that the lack of exact coincidence between the location and direction of the two midlines, dental and interpupillary (Figure 3B), is common and not necessarily an esthetic liability.[2,12]

Some authors related that the facial midline may be coincident with the middle of the mouth, using the philtrum as a guide[3,13–15] and the interpupillary line should be parallel with the horizon line and perpendicular to the midline of the face.[6] Therefore, if the interpupillary bisector should be parallel with the midline of the face, it is suggested by the present study that this line may also be used as a reference line in facial measurements.

Some studies established a correlation between the position of dental and facial midlines, having similar results compared with the present study, in which the midline of the incisors did not cross exactly in the middle of the face.[9,14] Therefore, as the median line of the incisors moved further from the midline of the face, the models analyzed became less esthetically attractive.[13,16]

A previous study evaluated whether the coincidence between facial midline and dental midline exists and concluded that, in cases in which there was no coincidence between these lines, it did not matter in which direction the discrepancy occurred.[9]

Because no human face is symmetrical, one must take all of the factors inherent to the case into

consideration when starting a rehabilitating treatment. When planning restorative treatment, besides the anthropometric measurements, we should consider the interrelationship among all of the supporting structures of the face, including muscles, bones, gingival, and soft tissues. It has to be remembered that these measurements should be used only as reference values[17] because the lack of exact coincidence between the location and direction of the maxillary and interpupillary midline is common and, therefore, not necessarily an esthetic liability.[2]

CONCLUSION

As a result of the methodology applied and the results obtained, it could be concluded that there is no coincidence between the maxillary midline and the perpendicular midline bisector of the interpupillar distance.

DISCLOSURE

The authors do not have any financial interest in the companies whose materials are included in this article.

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Reprint requests: Evania Eskelsen, DDS, MSc, Rua Sete de Setembro 178, Guaratinguetá, SP, Brasil 12500-330; Tel: 55-12-3132-5162; Fax: 55-12-3632-4968; email: eveskelsen@uol.com.br