



Discord Between the Facial and Maxillary Midline and Intermaxillary Midline Among the Population of Asir, Saudi Arabia

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Abstract

Objective: To determine the proportion of Saudi population in the Asir region that displayed discordance between the facial and maxillary midline and intermaxillary midline, to form an informative guideline for esthetic rehabilitation of patients. **Material and Methods:** We evaluated 2418 Saudi citizens using positioning guides of the orthopantomography machine to record the relationship of the dental midline to the facial midline. The relationship of the maxillary midline to that of the mandible was observed clinically, and diagnostic mounting of particular cases was performed for confirmation. The examination was carried out by four trained observers (two dentists and two radiology technicians) to overcome the parallax effect. The cases with disagreements were repeated. The record was grouped into (1) coincidence, (2) deviation of the mandible to the right, and (3) deviation to the left. The relationship between facial-dental midline concordance and intermaxillary concordance was assessed using the Chi-squared test. **Results:** Facial and maxillary midline did not coincide in 42.5% participants, whereas intermaxillary midline discordance was observed in 51.5%. Among those exhibiting discordance, 57% had right discordance and 43% had left discordance. **Conclusion:** A significant proportion of the population displayed discordance between the facial-maxillary midline as well as the intermaxillary midline. The female population showed not only a higher number of intermaxillary discordance than males but also a significant number of intermaxillary discordance towards the right.

Keywords: Orthodontics; Malocclusion; Facial Asymmetry; Reproducibility of Results.

Introduction

Esthetic dentistry has evolved over a period of time, and the recent increase in esthetic demands of the patients have led clinicians to give more importance to facial esthetics [1]. Patients consider facial esthetics as one of the primary reasons for seeking dental and cosmetic treatments [2-4]. The term esthetics is derived from the Greek word 'aisthetikos' meaning sensory perception [5]. The assessment of esthetics is essentially subjective, and the perception of the patients and dental professionals may not match all the time [6]. However, there is scope to perform the assessment of facial symmetry and proportions objectively [7].

Facial symmetry refers to an absolute similarity in size, location, shape, and arrangement of the facial components on either side of the sagittal plane [8]. Perfectly bilateral facial symmetry is a theoretical concept that rarely exists in nature. Mild asymmetries occur in the human face, just as seen everywhere in nature [9,10]. Small, random fluctuations from the ideal bilateral symmetry are often termed as fluctuating asymmetry [11]. Many environmental factors, as well as genetic factors, have been linked to the dissimilarities in the face [12]. Research has also suggested the association of fluctuation asymmetry with physical health, intelligence, and personality traits [13-15].

Defining the location of the facial midline is critical in providing esthetic treatment of facial asymmetry [16]. Facial symmetry and the midline can be evaluated through clinical assessment, photography, cephalography, and 3-D computed tomography [9]. Various facial landmarks used in determining the facial midline include the philtrum, nasion, tip of the nose, center of the nose, and bisector of the pupil [17]. Trubyte tooth indicator instrument is one of the instruments used to determine the midline [18].

The relationship between the dental midline and facial midline is one of the factors examined in the esthetic evaluation [19]. It was previously emphasized the importance of coinciding the maxillary-mandibular midline to produce a desirable effect of 'cohesiveness' or 'oneness' of the dental composition and to give proportion to the face, thus aiding in better esthetics [20,21]. Several studies were carried out on midline asymmetries, and most of them recorded discrepancies of approximately 2-3 mm as an average value among different populations [22,23]. Most of these minor asymmetries are not observed by the layman. A deviation of 1-2 mm is only observed by 50% of people, while a deviation of 2 mm or more is easily noted [24]. An acceptable deviation of the midline is approximately 2.2 mm [25], whereas, in other studies, the threshold ranged from 1 to 3 mm [26,27].

Understanding the proportion of population showing discordance of the dental midline to the facial midline and maxillary midline to the mandibular midline is important information for prosthodontists, orthodontists, and maxillofacial surgeons to plan the treatment in their respective fields. There is not enough scientific data regarding these parameters in the Saudi Arabian population. The primary objective of this study was to determine the relationship of the facial midline with the maxillary midline and the intermaxillary midline amongst the population of Asir region of Saudi Arabia and to evaluate the proportion of population showing discordance in these parameters.

Material and Methods

Study Design and Sample

The present study was conducted on the ethnic Arab Saudi nationals belonging to the Asir region. The patients attending the King Khalid University College of Dentistry were selected for the study, as it was the only institution serving the Asir region of Saudi Arabia. All the patients in the age group of 18 - 45 years, visiting the diagnostic clinic between September 2017 and May 2018, were screened.

A non-probability, judgmental method was followed in selecting subjects. The subjects exhibiting an Angle's class I without significant malalignments, a full complement of teeth, and healthy periodontium were included in the study. Non-ethnic Arab citizens, expatriates, and subjects with midline diastema, congenital or acquired maxillofacial deformity, gross facial asymmetries, history of orthodontic treatment, multiple grossly carious teeth, and multiple crown or bridges were excluded from the study. After excluding a significant population, 2418 subjects were included in the study.

Data Collection

Relation of the Facial Midline with the Maxillary Midline

The position guides of an orthopantomographic unit were used to check this parameter. The three points marked on the subjects' faces with a 0.5 mm erasable ink pen included the nasion, tip of the philtrum, and center of the chin. The subject was positioned appropriately at the orthopantomographic machine (Orthophos SL 2D, Sirona Dental Systems, Bensheim, Germany) and was asked to bite on the incisal rod with the central incisors. Temporal and frontal skull head support bars assisted patient positioning and helped to reduce head tilting and horizontal misalignment. Light beam reference lines provided the final visualization for studying the relationship of the facial midline with the maxillary midline. The patient was asked to bite on the incisal rod and part the lips. While the midsagittal light beam helped in determining the relationship of the midlines, the Frankfort plane and canine plane beams helped to fine tune the patients' head position (Figure 1). The examination was carried out by four trained observers (two dentists and two radiology technicians) to overcome the parallax effect. The cases with disagreements were repeated.

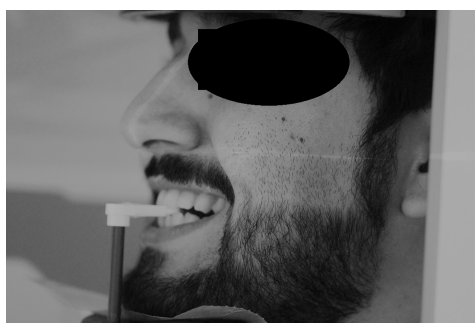


Figure 1. Subject head was aligned on an orthopantomographic machine using positioning guides: the bite rod, head guides, and guiding light beams in the mid-sagittal plane, Frankfort plane, and canine reference line.

Method to verify the coincidence of maxillary midline with mandibular midline: The subject was seated in an upright position, and the dental chair was raised to match the patient's occlusal plane with the examiner's eye level. The subject was guided to bite in centric occlusion, and the coincidence of the midlines was examined by two dentists from the frontal view by gently parting the lips. Diagnostic impression followed by mounting was performed for the subjects who posed a difficulty for the examiners in evaluating parameters (Figure 2).

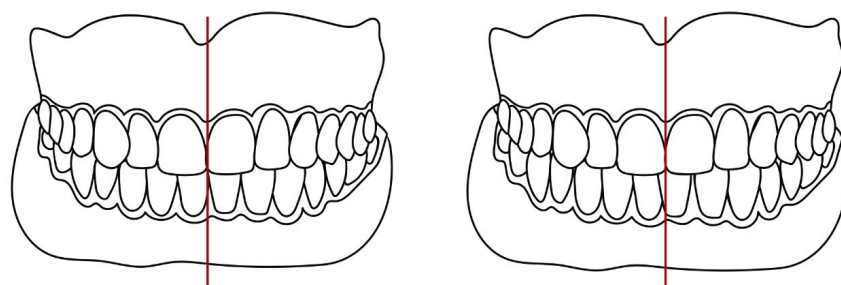


Figure 2. Schematic illustration of concordance and discordance of the intermaxillary midline on the diagnostic casts mounted on an articulator.

The record was grouped into (1) coincidence, (2) deviation of the mandible to the right, and (3) deviation to the left.

Data Analysis

The data were tabulated, and IBM SPSS Statistics Software, version 20 (IBM Corp., Armonk, NY, USA), was used for analysis. The relationship between facial-dental midline concordance and intermaxillary concordance was assessed using the Chi-squared test.

Ethical Aspects

This study was approved by the Institutional Review Board of King Khalid University College of Dentistry. All participants signed an informed consent form in accordance with the Declaration of Helsinki.

Results

The mean age of the subjects was 28.4 years, with 1278 (53%) males and 1140 (47%) females. Dentists and non-dental personnel demonstrated similar ability in noticing the deviations of the maxillary and facial midlines. Facial and maxillary midline coincided in 1390 (57.5%) patients (Table 1). Among the patients presenting discordance, 530 (51.6%) had a deviation of dental midline towards the right, while 498 (48.4%) showed a left discordance (Table 2).

Of the total subjects enrolled, 522 (21.6%) posed difficulty in the clinical judgment of the maxilla-mandibular midline coincidence. Such cases were verified using diagnostic mounting. Maxillary-mandibular midline coincidence was observed in 1196 subjects (49.5%) (Table 3). Among

those with discordance, 696 (57%) and 526 (43%) presented right and left discordance, respectively (Table 4).

Table 1. Distribution of participants according to coincidence of facial-maxillary midline between genders.

Gender	Facial-Dental Midline Coincidence				p-value
	Discordance		Concordance		
	N	%	N	%	
Male	560	43.8	718	56.2	0.09
Female	468	41.1	672	58.9	

Table 2. Right versus Left discordance across gender among patients with Facial-maxillary midline discordance.

Gender	Facial-Dental Midline Discordance				p-value
	Right		Left		
	N	%	N	%	
Male	212	37.9	348	62.1	<0.001
Female	318	67.9	150	32.1	

Table 3. Distribution of participants according to the coincidence of the maxillary-mandibular midline between genders.

Gender	Maxillary-Mandibular Midline Coincidence				p-value
	Discordance		Concordance		
	N	%	N	%	
Male	598	46.8	680	53.2	<0.001
Female	624	54.7	516	45.3	

Table 4. Right versus left discordance across genders among patients with maxillary-mandibular midline discordance.

Gender	Maxillary-Mandibular Midline Discordance				p-value
	Right		Left		
	N	%	N	%	
Male	320	53.5	278	46.5	<0.001
Female	376	60.3	248	39.7	

Inferential statistics showed that the right facial-dental midline concordance was more common among females than in males (Table 2). Similarly, intermaxillary discordance was higher among females as compared to males (Table 3). Right-sided maxillary and mandibular discordance was more common among females.

The relationships among facial-maxillary midline concordance, intermaxillary concordance, and other categorical variables were assessed using the Chi-squared test with p-value <0.05 considered statistically significant (Table 5).

Table 5. Relationship between facial-dental and maxillary-mandibular midline concordance.

Maxillary-Mandibular Concordance	Facial-Dental Midline Coincidence				p-value
	Discordance		Concordance		
	N	%	N	%	
Discordance	1028	84.1	194	15.9	<0.001
Concordance	0	0.0	1196	100.0	

Discussion

The position guides of an orthopantomographic unit were used to check the parameters of the study. This technique has not been used in any similar research. The techniques used in other investigations include the Trubyte tooth indicator [2], clinical assessment method [28], computer analysis of digital photographs [3,6,19,25,26,29], and 3-D computed tomography. The computer analysis of digital photographs is the most commonly used method to evaluate the midline. The accuracy of positioning guides of the orthopantomographic machine is comparable to the computer analysis of digital photographs with an additional advantage of ease and speed in determining the results. This allowed the current study to cover a large sample size, whereas other researchers could only cover a sample size of approximately 100 subjects. The error of the visual accuracy of the examiners was reduced by involving four examiners for every sample.

The results of the current study showed that approximately 57.5% of the people of Asir region of Saudi Arabia displayed coincidence of the facial midline with the dental midline, but 42.5% presented discordance of which 51.6% had it on the right, and 48.4% had it on the left. In a similar study conducted in Karachi, Pakistan, a facial midline to maxillary midline coincidence of 82.8% was obtained [28]. However, the evaluation was performed using the clinical assessment method. Another study conducted in the Karnataka population in India, using Trubyte tooth indicator, reported a 72.5% coincidence of these two midlines, whereas a study conducted in the same region of India using computer analysis of digital photographs showed a coincidence of 50% [30]. There has been a considerable variation in the parameter in different regions of the world with different techniques used in the same region. However, most of the researches using computer analysis of digital photographs showed coincidence results close to 50%. Moreover, no other research in the literature has covered a sample size as large as the current study.

The current study displayed a maxillary to mandibular midline coincidence of 49.5%. Among the people showing discordance, 57% and 43% presented right and left discordance, respectively. None of the studies correlated the maxillary midline with that of the mandibular midline. Furthermore, no studies in the literature have compared the prevalence of discordances in the male and female population.

This study evaluated the concordance and discordance between the midlines of the face and maxilla and between the maxilla and mandible. Although the study revealed that a significant population of the Asir region of Saudi Arabia displayed a discordance, it did not evaluate the quantity of discordance. This parameter needs further research. The 3-D digital planning technique, similar to that described previously [31], could prove beneficial in analyzing the quantity of deviation, determining the perception of esthetics by the dentists and the patient, and also benefit the treatment planning process by providing better visualization of the projected results by the dentist and the patient.

Conclusion

There is a significant proportion of population showing discordance in facial-maxillary midlines as well as the intermaxillary midline. The male and female population displayed similar proportions of facial-maxillary midline concordance, but intermaxillary discordance was higher in females than in males. Majority of the facial-maxillary discordance cases in males and females were towards the left and right side, respectively. The intermaxillary discordance distribution was almost balanced in males, but females displayed a more significant number of discordances towards the right.

Authors' Contributions: MFK, SS, MS and MKA designed the study, performed the data collection, data analysis and interpretation, wrote the manuscript and reviewed the manuscript. FMB and SAA performed the data collection, data analysis and interpretation, and wrote the manuscript. All authors declare that they contributed to critical review of intellectual content and approval of the final version to be published.

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