ORIGINAL ARTICLE

Coincidence of Dental Midline with Facial Midline in a Sample of Pakistani Population

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ABSTRACT

Objective: To determine the frequency of coincidence of facial and dental midlines in a sample of Pakistani subjects.
Study Design: Cross-sectional study.
Place and Duration of Study: Department of Prosthodontics, Fatima Jinnah Dental College and Hospital, Karachi, from October to December 2017.
Methodology: Subjects of either gender (n=117) were selected from pool of otherwise healthy dental students. Facial portrait photographs using a DSLR camera were obtained while keeping the teeth in maximum inter-cuspation position. Auto-CAD software was used to analyse the coincidence of facial, maxillary and mandibular midlines. SPSS Version 23.0 was used for data analysis. The coincidence of the midlines were determined using Pearson correlation test. Level of significance was set at 0.05.
Results: The coincidence of maxilla-mandible midlines was 64.1% (75/117); whereas, coincidence of facial midline with maxillary and mandibular midlines were 47.9% (56/117) and 46.1% (54/117), respectively. Left sided deviations of dental midlines were more frequent than the right side.
Conclusion: The coincidence of inter-maxillary midlines was seen in two-thirds of the participants only. The dental midlines were coincident with the facial midline in less than half of the sample.

Key Words: *Facial midline, Dental midline, Maxillary midline, Esthetics.*

INTRODUCTION

Symmetry is considered as an essential pre-requisite for bringing harmony and balance in the esthetics of dento-facial complex.[1] A good knowledge of the midline helps in a better understanding of facial and dental esthetics. The facial midline is defined as "the vertical line bisecting a horizontal line originating at the exocanthion of one eye and meeting the exocanthion of the other eye".[2] A patient readily recognises an asymmetrical midline; however, none of the facial feature is completely symmetrical or centered.[3] Dental midline is the most focal point in the esthetics of a denture.[4] Establishment of a symmetrical dental midline is one of the major considerations in arrangement of the anterior teeth.[5] A suitably positioned midline in combination with a long solid interproximal contact relationship between the two maxillary central incisors results in the desired "cohesiveness" or "oneness" of the dental composition.[3] Glossary of prosthodontic terms (May 2017) defines the dental midline as "the reference to a vertical line drawn through the tip of the incisal embrasure between the two maxillary central incisors and parallel to the vertical lines of the esthetic frame of the face".[2]

There is a debate in the literature regarding the placement of the dental midline to be coincident with the midline of the face or the midline of the oral commissures.[4] Tjan and Miller considered creating the dental midline coincident with the midline of the oral commissures, because patients usually relate their midline to the upper lip rather than to other facial structures which are farther from the mouth.[3] It is desirable but not obligatory that the facial, maxillary, and mandibular midlines are coincident.[1] The role of the maxillary dental and facial midlines in esthetics is well recognised by prostho-dontists, ortho-dontists, and facial plastic surgeons.[1]

The objective of this study was to investigate the coincidence of the facial and dental midlines in otherwise healthy subjects. This will help the dentists in formulating the guidelines regarding the placement of midline during fabrication of esthetic dental restorations.

METHODOLOGY

This descriptive study was conducted from October to December 2017 at the Department of Prosthodontics, Fatima Jinnah Dental College and Hospital, Karachi. Subjects of either gender aged 20-30 years, all anterior teeth present with normal alignment, and without any caries, periodontal disease or mobility, were included. Individuals excluded from the study were those with history of previous orthodontic treatment, prosthetic treatment in the anterior teeth, trauma, surgery, missing

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or crowded dentition. Subjects with the history of facial palsy, neuropathy, congenital facial abnormality and linear smile (anterior teeth are not exposed during posed smile) were also excluded. Sample size was calculated using the reference of Eskelsen *et al*.[6], where the investigators calculated the sample size n=102. Inflation of 15% was employed to yield a sample size of 117 participants. Research was approved by the Institutional Ethical and Scientific Review Board, which was taken on September 18, 2017. Informed consent was obtained from all participants after explaining the nature of the study in detail. Full face photographs of 117 individuals were taken with teeth in occlusion, using a digital camera (Nikon D5300 with 105-mm lens). A metallic scale with millimeter markings was held along the face in all photographs to be used as a reference for resizing the images with the software. Computer software AutoCAD 2017 was used to analyse the photographs.

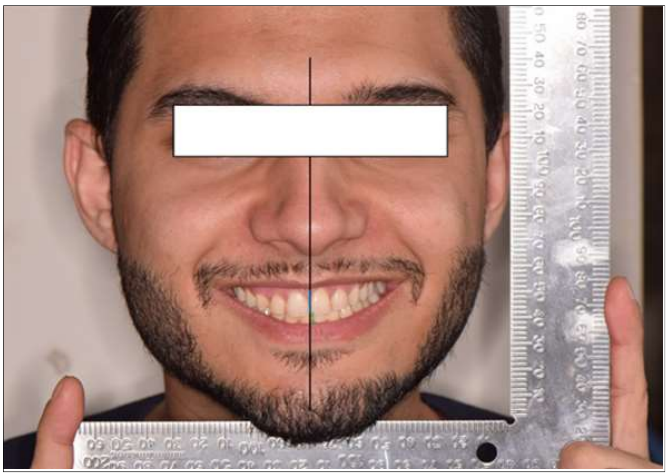

Figure 1: Facial portrait of a study participant exhibiting facial, maxillary and mandibular midlines.

Table I: Coincidence of dental and facial midlines (n=117).

Midline	Coincident n (%)	Shifted towards right n (%)	Shifted towards left n (%)
Maxillary to Facial	56 (47.9%)	24 (20.5%)	37 (31.6%)
Mandibular to Maxillary	75 (64.1%)	20 (17.1%)	22 (18.8%)
Mandibular to Facial	54 (46.2%)	25 (21.4%)	38 (32.5%)

Distance of facial midline with the maxillary dental and mandibular dental midline were measured (Figure 1). Moreover, the coincidence in relationship of the two dental midlines was observed.

Facial midline was marked as the centre of the esthetic frame of the face according to the definition given in the glossary of prosthodontic terms by drawing a vertical line bisecting a horizontal line drawn through the exocanthion of one eye to the other. This line was related to the maxillary dental midline which was taken as the contact area between the maxillary central incisors. Facial midline and maxillary dental midline were also related to mandibular dental midline, which was taken by the contact area between the mandibular central incisors. Negative values indicated deviations of the dental midline towards left in relation to facial midline while positive values were given to right side deviations of the dental midline. SPSS version 23.0 was used for data analysis. Pearson's correlation coefficient was applied to determine the correlation among facial and dental midlines. The level of significance level was kept at 0.05.

RESULTS

One hundred and twenty-four subjects were evaluated for the study, of which 117 were finally selected. Of these participants, 76.06% (89) were females and 23.93% (28) were males with mean age of 22.81 ±1.36 years.

The interrelationship of the facial, maxillary, and mandibular midlines were evaluated (Table I). It was found that both the maxillary and mandibular midlines coincided in 64.1% (75/117) with each other. In addition, deviations of the maxilla-mandibular midline was not uncommon. Both the dental midlines were more found to be deviated towards left in relation to the facial midline (maxillary midline in 31.62% (37/117) and the mandibular midline in 32.48% (38/117) participants).

Table II shows the interrelation of the maxilla-mandibular and facial midlines. Bivariate correlation with Pearson's correlation coefficient was applied to correlate the three midlines which was found to be significant ($p < 0.01$). This signifies that if facial midline is deviated then dental midlines are likely to be deviated in the same direction.

Table II: Correlation among dental and facial midlines.

Correlations (n=117)	Maxillary midline in relation to facial midline	Mandibular midline w.r.t to maxillary midline	Mandibular. midline w.r.t facial midline
Maxillary midline in relation to facial midline			
Pearson correlation	1	-0.266**	0.645**
p-value	–	0.004	0.000
Mandibular midline w.r.t to maxillary midline			
Pearson correlation	–	1	0.545**
p-value	–	–	0.000
Mandibular midline w.r.t facial midline			
Pearson correlation	–	–	1
p-value	–	–	–

*** Correlation is significant at the 0.05 level (2-tailed). Pearson's correlation coefficient was applied.*

DISCUSSION

Matching of the dental midline either prosthetically or orthodontically is perplexing, and a debatable topic in dentistry. Kokich *et al*. challenged the need of an accurate dental midline for ideal esthetics.[7] Whereas, Frush and Golub proposed that the precise dental midline has the potential to look artificial.[8,9] William *et al*. suggested that the amount of deviation in the dental midline perceived is affected by the facial type.[10] Pinho *et al*. conducted a study in which they evaluated the difference in perceptions among prosthodontists, orthodontists, and lay persons regarding the midline shift and smile esthetics. They concluded that orthodontists can appreciate even 1-mm discrepancy in the facial and dental midline, while prosthodontists at an average can perceive a midline shift of 3 mm; however, lay persons (non-professionals) did not appreciate even 3mm discrepancy.[11]

The likely match of the facial and dental midline is the initial step in the esthetic rehabilitation of the dental patient.[1,4,6,12-17] Matching of the maxillary dental midline with the facial midline is more important for the better esthetic outcomes compared with the coincidence of mandibular dental midline with the facial midline. This may be explained by the fact that the maxillary anterior teeth are mainly visible during smile and function.[1] Digital photography is cost- and time-effective method that is used in other studies.[6,12,13] In this study, authors used Nikon D5300 with 105-mm lens mounted on the tripod stand at the height of the participant's face with constant camera settings and distance. Two soft box flash lights placed at fixed distance from the subjects for better illumination of the participant's face with minimum shadow.

Different facial anatomic landmarks, such as the bisector of the pupils, nasion, tip of the nose, tip of the philtrum, and chin, have been used to determine the facial midline.[5,18,19] Intraorally, the incisive papilla is a stable landmark for determination of the maxillary dental midline.[20,21]

Authors found in this study that the maxillary midline was coincident with the facial midline in 47.9% (56) of the subjects. Similar to this study, Eskelsen *et al*. found only 38% of the participants to have inter-pupillary midline coinciding with the maxillary midline.[6] In contradictory to this, Miller *et al*. considering philtrum as the alternative of the facial midline, found that the maxillary dental midline coincided in 75% with the median line of the philtrum in the 500 participants with natural dentition.[5] Nold *et al*. examined 106 Caucasian participants and found that 85% had coinciding facial and dental midlines.[12] Similarly, Bhateja *et al*. reported coincidence of the facial and maxillary midlines in 83.7% of their patients with permanent dentition.[16]

In the present study, the frequency of maxillary to facial midline deviations was 61/117 (52.1%); of these, majority 37/61 (60.5%) were deviated towards left side. Jayalakshmi *et al*. noticed maxillary midline to be 1.62 ±0.43 mm in male and 1.32 ±0.16 mm in female to be shifted in relation to the facial midline. They also proposed that maxillary dental midline should be placed in coincidence with the facial midline or slightly at a difference of not more than 2-mm. However, Jayalakshmi *et al*. did not report the side of midline deviation.[13] Eskelsen *et al*. reported that when the maxillary midline is deviated then it is more frequently deviated towards left in both the genders.[6] This is in agreement with the present study. People consider dental midline discrepancies a factor in reducing smile attractiveness; discrepancies of 2 mm or more have 56% chance of being noticed by laypeople.[22] It is considered that minor discrepancy in the midlines is acceptable.[16]

The mandibular midline was coincident with the facial midline in 46.2% subjects included in this study. The mandibular midline deviated, 32.48% towards left and 21.4% towards right, with reference to facial midline. Bhateja *et al*. found 68.3% deviation of mandibular midline from the facial midline which is of higher value.[16] They did not differentiated the direction of midline shift.

Moreover, it was also observed that maxillary and mandibular midlines coincided in 64.1% cases. This is different from Miller *et al*., who reported the frequency of midline coincidence of 29.2% and 26.2% among Caucasians and non-Caucasians, respectively.[5] Jayalakshmi *et al*. observed maxilla-mandibular dental midline discrepancy in almost 80% of the Indian students included in their study.[13] Bhateja *et al*. too reported that 32.6% of their sample did not had coinciding dental midlines.[16]

The difference in the results of the present study from the study of Bhateja *et al*., which was also conducted in Pakistani population, may be attributed to the facts that they had also included mixed dentition cases, did not use high definition images for the evaluation of the midlines relationship, and the sample included in their study was composed of pre-treatment records of orthodontic patients.

The limitation of the present study is that the data was not stratified on the basis of gender or ethnicity, as a number of studies showed that such differences in midline coincidence is not significant.[5,12,13]

CONCLUSION

On the basis of the outcome of this study, it can be concluded that there is prevalence of coinciding maxillary and mandibular midlines in two-thirds of the participants studied. Coincidence of dental and facial midlines is relatively uncommon. It may be more likely that the dental midline occurring naturally are deviated towards the left side of the face.

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