

## The Effect of Linear and Angular Midline Deviation on Smile Attractiveness Regarding Facial Height

**Behrad Tanbakuchi<sup>1</sup>, Sepideh Arab<sup>2</sup>, Esfandiar Akhavan Niaki<sup>3</sup>, Mohamad Moslem Imani<sup>4</sup>, Sara Valizadeh<sup>5</sup>, Ahmad Reza Shamshiri<sup>6</sup>**

<sup>1</sup> Assistant Professor, Department of Orthodontics, School of Dentistry, Tehran University of Medical Sciences, Tehran, Iran

<sup>2</sup> Associate Professor, Department of Orthodontics, School of Dentistry, Tehran University of Medical Sciences, Tehran, Iran

<sup>3</sup> Professor, Department of Orthodontics, School of Dentistry, Tehran University of Medical Sciences, Tehran, Iran

<sup>4</sup> Associate Professor, Department of Orthodontics, School of Dentistry, Kermanshah University of Medical Sciences, Kermanshah, Iran

<sup>5</sup> Associate Professor, Restorative Dentistry Department, School of Dentistry, Tehran University of Medical Sciences, Tehran, Iran

<sup>6</sup> PhD, Dental Research Center, School of Dentistry, Tehran University of Medical Sciences, Tehran, Iran

*Received 12 April 2021 and Accepted 11 August 2021*

### Abstract

**Introduction:** The aim of the present study was to evaluate ordinary people's perception about smile attractiveness in long face and short face subjects with linear and angular midline deviations. **Methods:** Frontal facial smiling images of two young Iranian females (one short face and one long face) were manipulated by Adobe Photoshop CS3 software. Four photos with different linear midline deviations to right (1mm, 2mm, 3mm and 4mm) and four photos with counter clockwise angular midline deviation (2°, 6°, 10°, 14°) were produced. Sixty Iranian individuals (30 males and 30 females) were asked to determine from which photo on, they found that the smile is unattractive. **Results:** Unlike angular midline deviation, there was no statistically significant difference in the acceptability limitation for linear midline deviation between long face and short face subjects. The mean of unattractive limitation for angular midline deviation was 8.44° and 6.56° in long face and short face subjects, respectively. No statistically significant differences were found in ratings between male and female examiners. **Conclusion:** Angular midline deviation is more acceptable in long face people. On the other hand, the attractiveness of the two facial types is similarly affected by linear midline deviation.

**Keywords:** Facial height, Midline, Smile

---

Tanbakuchi B, Arab S, Akhavan Niaki E, Imani MM, Valizadeh S, Shamshiri AR. The Effect of Linear and Angular Midline Deviation on Smile Attractiveness Regarding Facial Height. J Dent Mater Tech 2021; 10(3): 157-163.

### Introduction

Smile esthetics has recently become an important demand for patients who seek orthodontic treatment (1, 2). It also has a specific importance for the orthodontists because the results of treatment are criticized by ordinary(non-dentist) people mostly based on how the smile look like (3).

People with attractive smiles are more socially acceptable and are more successful in their relationships. In fact, smile and facial aesthetics could positively affect people's self-confidence and self-esteem (4, 5).

Several factors such as diastema, teeth size and shape, incisors position, midline discrepancies, buccal corridor, smile arc, gingival display and shape, lip height and so on have been reported to influence smile aesthetics. Various studies have been conducted to evaluate the effect of these characteristics on smile aesthetics (6, 7, 8).

Among the aforementioned factors, midline deviation is more frequent (9) and is somehow controversial. Acceptable thresholds of less than 2mm, 3mm or even 4mm have been reported for linear midline deviations (10-15).

On the contrary, there is general agreement that excessive gingival show as well as minimal teeth display are unattractive smile features (15, 16). In addition, smiles with minimal buccal corridor space have been reported as more popular (17-19). However, in our team recent study, we showed that the effect of buccal corridor width and tooth-gingiva display on smile attractiveness is influenced by subjects` facial height (20). Therefore, midline deviation might possibly follow the same trend.

In the present study, we tried to investigate whether threshold of acceptability for midline deviation is dependent to facial height.

## Materials and Methods

Completed files of two Iranian women (one long and one short face) with proper midlines and aligned anterior teeth were selected from the department of orthodontics archives. Facial types were determined regarding the Frankfort-mandibular plane angle (FMA), the Jarabak index and the ratio of the middle facial one-third to lower facial one-third based on the results of lateral cephalograms analysis (FMA= 15, Jarabak index=75 and g-sn/sn-me=55/45 for the short face patient and FMA= 35, Jarabak index=55 and g-sn/sn-me=45/55 for the long face one).

Frontal facial smiling photographs of both patients were altered using Adobe Photoshop CS3 software (Adobe Systems, San Jose, CA). Four photos with different midline deviations to right (1mm, 2mm, 3mm, 4mm) and four other photos with counter clockwise midline inclination ( $2^\circ$ ,  $6^\circ$ ,  $10^\circ$ ,  $14^\circ$ ) were produced. One normal photo from each situation was taken too. Patients` eyes were covered. Buccal corridors were adjusted to be the same in both sides. (Figure 1-4)



Figure 1: Illustration of different amounts of linear midline deviation in short face patient in an increasing deviation sequence, from no deviation to 4mm deviation



Figure 2: Illustration of different amounts of angular midline deviation in short face patient in an increasing deviation sequence, from no deviation to  $14^\circ$  deviation



Figure 3: Illustration of different amounts of linear midline deviation in long face patient in an increasing deviation sequence, from no deviation to 4mm deviation



Figure 4: Illustration of different amounts of angular midline deviation in long face patient in an increasing deviation sequence, from no deviation to 14°deviation

In order to determine the threshold of acceptability for linear midline deviation, the images were set in an increasing midline deviation order and printed on 18cm x 24cm papers.

The reliability of the study was evaluated through a pilot study by participating 10 ordinary persons (5 women and 5 men).

The study population included 60 Iranian ordinary people (30 men and women) with a mean age of  $25.5 \pm 3.2$  years old. None of them stated any history of training in dental or facial aesthetics or orthodontic treatment. They were asked to choose the photo in which the smile was not acceptable anymore.

The same method was used for evaluation of midline angular deviation.

#### *Statistical analysis*

Inter Class Correlation (ICC) test and Weighted Kappa test were used to assess the reliability.

We used Frequency table to determine threshold of smile acceptability for midline deviation. In order to confirm reliability, rating was performed by 10 examiners twice

in a two-week interval and ICC test results for linear midline and angular deviations were 0.873 and 0.943, respectively.

Chi square was applied to compare the male and female examiners. Independent T Test was used to compare the threshold of midline deviation acceptability in two facial types. P values less than 0.05 were considered statistically significant.

## **Results**

### *Linear midline deviation*

Results of the present study showed that mean numbers for maximum acceptable midline deviation in long face and short face patients are  $2.13 \pm 0.85$  mm and  $2.32 \pm 0.83$  mm, respectively. Comparison of data using T Test revealed that there is no statistically significant difference between the limit of acceptability for midline deviation between two groups. (P-Value = 0.24)

Chi square revealed no significant difference between male and female examiners in both short face (P-Values=0.45) and long face (P- Value=0.93) cases.

Figure 5 shows the detailed data regarding linear midline deviation in both long face and short face patients.

#### *Angular midline deviation*

The mean acceptable amounts for angular midline deviation in long face and short face patients were  $8.47 \pm 3.13^\circ$  and  $6.53 \pm 2.80^\circ$ , respectively. There was a

statistically significant difference between long face and short face images ( $P=0.0001$ ), while Chi square showed no significant difference between male and female examiners in short face ( $P\text{-Value}=0.42$ ) and long face ( $P\text{-Value}=0.25$ ) cases.

Figure 6 shows the detailed data regarding Angular midline deviation in two groups

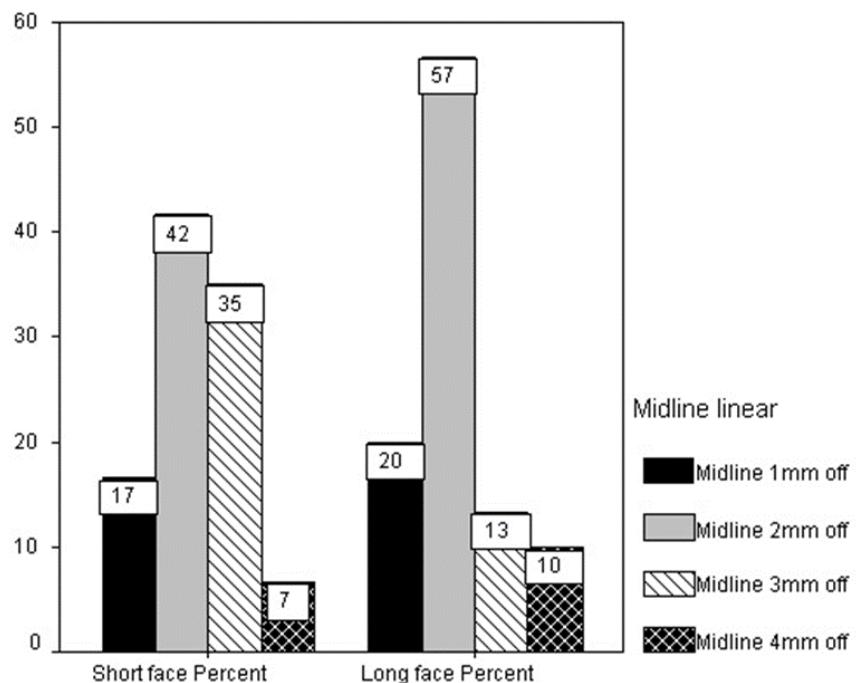


Figure 5: Percentage of votes for acceptability limitation of linear midline deviation in long face and short face patients

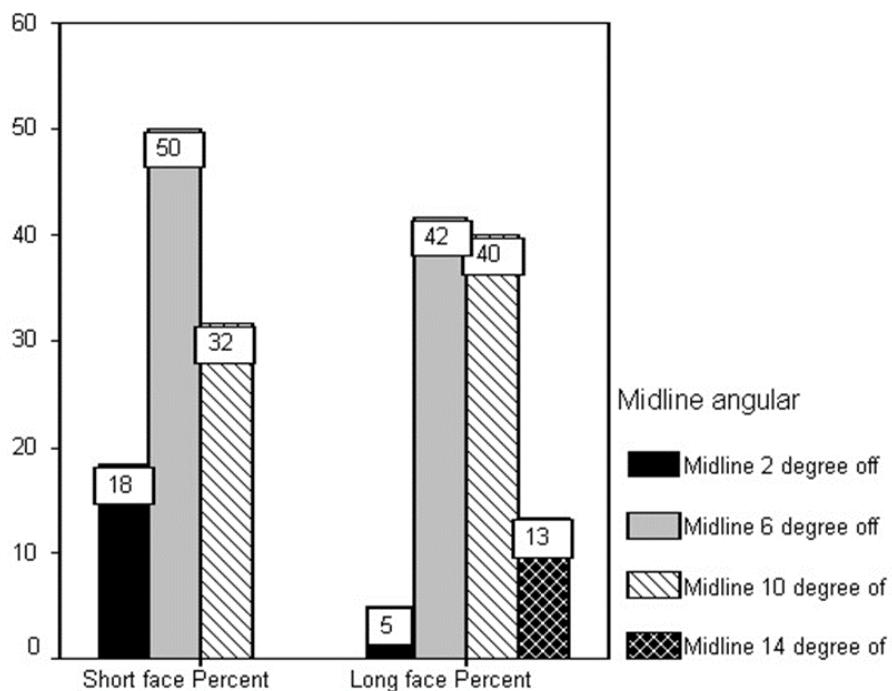


Figure 6: Percentage of votes for acceptability limitation of angular midline deviation in long face and short face patients

## **Discussion**

Deviation of dental midline from facial midline can adversely affect smile acceptability and facial aesthetics (6). Literature shows controversies about the level of acceptability for midline deviation from less than 2mm up to 4mm (6, 11, 12, 21- 23).

Esthetic standards for smile are mostly acquired from the images of mouth only, or photos of subjects with normal and average facial proportions. These standards are also affected by cultural, social and ethnic figures (17, 24, 25).

Considering previous studies which have shown that the effect of buccal corridor on smile aesthetics is strongly depended on facial height as well as ethnic factors (20, 26) we assumed that other smile components such as midline could possibly be affected by facial height.

In the present study, we applied full-face photos to allow the examiners evaluate midline in long face and short face subjects. Another reason that full facial image was chosen, was based on the data from Ferreira et al. who showed that ordinary people's perception of midline is affected by the amount of adjacent structures` show (27).

Results of the present study were similar to those reported by William et al. who did not find any statistically significant differences in threshold of acceptability for linear midline deviation between long face and short face subjects (28).

In our previous study, we showed that the effects of buccal corridor and tooth show on smile aesthetics in long and short-face subjects are based on their harmony with the geometry of face in vertical and transverse dimensions. Similarly, there is a geometric relationship between midline deviation and symmetry of face shown by Silva et al. They found that in asymmetric faces, ordinary people prefer cant of dental midline in the same direction of nose and chin deviation rather than the opposite way (29).

This study had also some limitations including searching for documents of appropriate short face and long face patients and providing accurate photoshop photos.

## **Conclusion**

The present study revealed another geometric association between midline deviation and facial form: higher amounts of angular midline deviation are perceived acceptable by lay people.

## **Acknowledgement**

The authors would like to thank Dr. Ahmadreza Shamshiri for doing statistical analysis.

## **Conflict of Interest**

The authors declare that there is no conflict of interest.

## **References**

1. Proffit WR. The soft tissue paradigm in orthodontic diagnosis and treatment planning: a new view for a new century. *J Esthet Dent.* 2000;12(1):46-49.
2. Kiyak HA. Does orthodontic treatment affect patients' quality of life? *J Dent Educ.* 2008;72(8):886-894.
3. Parekh S, Fields HW, Beck FM, Rosenstiel SF. The acceptability of variations in smile arc and buccal corridor space. *Orthod Craniofac Res.* 2007;10(1):15-21.
4. Langlois JH, Kalakanis L, Rubenstein AJ, Larson A, Hallam M, Smoot M. Maxims or myths of beauty? A meta-analytic and theoretical review. *Psychol Bull.* 2000;126(3):390-423.
5. Shaw WC, Rees G, Dawe M, Charles CR. The influence of dentofacial appearance on the social attractiveness of young adults. *Am J Orthod.* 1985;87(1):21-26.
6. Janson G, Branco NC, Fernandes TM, Sathler R, Garib D, Lauris JR. Influence of orthodontic treatment, midline position, buccal corridor and smile arc on smile attractiveness. *Angle Orthod.* 2011;81(1):153-161.
7. Parrini S, Rossini G, Castroflorio T, Fortini A, Dereibus A, Debernardi C. Laypeople's perceptions of frontal smile esthetics: A systematic review. *Am J Orthod Dentofacial Orthop.* 2016;150(5):740-750.
8. Rashed R, Heravi F, Raziee L. Smile Analyzer: a software package for analyzing the characteristics of the speech and smile. *J Dent Mater Tech.* 2012;1(1):1-5.
9. Jimenez-Castellanos E, Orozco-Varo A, Arroyo-Cruz G, Iglesias-Linares A. Prevalence of alterations in the characteristics of smile symmetry in an adult population from southern Europe. *J Prosthet Dent.* 2016;115(6):736-740.
10. Zhang YF, Xiao L, Li J, Peng YR, Zhao Z. Young people's esthetic perception of dental midline deviation. *Angle Orthod.* 2010;80(3):515-520.

11. McLeod C, Fields HW, Hechter F, Wiltshire W, Rody W, Jr., Christensen J. Esthetics and smile characteristics evaluated by laypersons. *Angle Orthod.* 2011;81(2):198-205.
12. Johnston CD, Burden DJ, Stevenson MR. The influence of dental to facial midline discrepancies on dental attractiveness ratings. *Eur J Orthod.* 1999;21(5):517-522.
13. Springer NC, Chang C, Fields HW, et al. Smile esthetics from the layperson's perspective. *AJO-DO.* 2011;139(1):e91-e101.
14. Pinho S, Ciriaco C, Faber J, Lenza MA. Impact of dental asymmetries on the perception of smile esthetics. *Am J Orthod Dentofacial Orthop.* 2007;132(6):748-753.
15. Kokich VO, Jr., Kiyak HA, Shapiro PA. Comparing the perception of dentists and lay people to altered dental esthetics. *J Esthet Dent.* 1999;11(6):311-324.
16. Mackley RJ. An evaluation of smiles before and after orthodontic treatment. *Angle Orthod.* 1993;63(3):183-189.
17. Ioi H, Kang S, Shimomura T, et al. Effects of buccal corridors on smile esthetics in Japanese and Korean orthodontists and orthodontic patients. *Am J Orthod Dentofacial Orthop.* 2012;142(4):459-465.
18. Moore T, Southard KA, Casko JS, Qian F, Southard TE. Buccal corridors and smile esthetics. *Am J Orthod Dentofacial Orthop.* 2005;127(2):208-213; quiz 261.
19. Tikku T, Khanna R, Maurya RP, Ahmad N. Role of buccal corridor in smile esthetics and its correlation with underlying skeletal and dental structures. *Indian J Dent Res.* 2012;23(2):187-194.
20. Niaki EA, Arab S, Shamshiri A, Imani MM. The effect of the buccal corridor and tooth display on smile attractiveness. *Aust Orthod J.* 2015;31(2):195-200.
21. Shyagali TR, Chandrakha B, Bhayya DP, Kumar S, Balasubramanyam G. Are ratings of dentofacial attractiveness influenced by dentofacial midline discrepancies? *Aust Orthod J.* 2008;24(2):91-95.
22. Ker AJ, Chan R, Fields HW, Beck M, Rosenstiel S. Esthetics and smile characteristics from the layperson's perspective: a computer-based survey study. *J Am Dent Assoc.* 2008;139(10):1318-1327.
23. Espana P, Tarazona B, Paredes V. Smile esthetics from odontology students' perspectives. *Angle Orthod.* 2014;84(2):214-224.
24. Oumeish OY. The cultural and philosophical concepts of cosmetics in beauty and art through the medical history of mankind. *Clin Dermatol.* 2001;19(4):375-386.
25. Sadrhaghghi AH, Zarghami A, Sadrhaghghi S, Mohammadi A, Eskandarinezhad M. Esthetic preferences of laypersons of different cultures and races with regard to smile attractiveness. *Indian J Dent Res.* 2017;28(2):156-161.
26. Zange SE, Ramos AL, Cuoghi OA, de Mendonca MR, Suguino R. Perceptions of laypersons and orthodontists regarding the buccal corridor in long- and short-face individuals. *Angle Orthod.* 2011;81(1):86-90.
27. Ferreira JB, Silva LE, Caetano MT, Motta AF, Cury-Saramago AA, Mucha JN. Perception of midline deviations in smile esthetics by laypersons. *Dental Press J Orthod.* 2016;21(6):51-57.
28. Williams RP, Rinchuse DJ, Zullo TG. Perceptions of midline deviations among different facial types. *Am J Orthod Dentofacial Orthop.* 2014;145(2):249-255.
29. Silva BP, Jimenez-Castellanos E, Stanley K, Mahn E, Coachman C, Finkel S. Layperson's perception of axial midline angulation in asymmetric faces. *J Esthet Restor Dent.* Mar 2018;30(2):119-125.

**Corresponding Author**

Sara Valizadeh

Associate Professor, Restorative Dentistry Department, School of Dentistry, Tehran University of Medical Sciences, Tehran, Iran

Tell: +98 912 348 8820

Email: valizadeh\_s@sina.tums.ac.ir