Original Article

Influence on smile attractiveness of occlusal plane cant in conjunction with axially dental midline deviation

Mostafa Sheikhi[1], Samira Asgari[1*]

[1]Department of Orthodontics, School of Dentistry, Zanjan University of Medical Sciences, Zanjan, Iran.

Correspondence: Samira Asgari, Department of Orthodontics, School of Dentistry, Zanjan University of Medical Sciences, Zanjan, Iran. Asgsam2000@gmail.com

ABSTRACT

Today, smile esthetics are the primary concern of patients and orthodontists. Very limited studies have assessed the interactions between beauty variables. This study aimed to investigate the impact of the occlusal plane cant combined with midline axial deviation on smile attractiveness and determine the combined esthetic threshold of these two variables. The study was performed in a population in Zanjan, Iran. Frontal photos of a woman and a man with an ideal smile were downloaded from the Internet. Five images with different angles of cant and midline were produced using Photoshop software. Then, 240 laypersons commented on the images based on the Likert scale. Percentages and frequencies were used to describe the values. The highest percentage of treatment need was in a photo with a 10° midline axial deviation and a 0° cant, and the lowest treatment need was related to a photo with a 2.5° midline axial deviation and a 3° cant. The treatment needed for the female image was higher than for the male image. The esthetic threshold for combining the cant of the occlusal plane and midline axial deviation was about 2° of cant and 5° of midline deviation from the point of view of Zanjani people. In conclusion, the midline angle deviation was more important than the occlusal plane cant in smile esthetics.

Keywords: Dental abnormalities, Dental esthetics, Smile, Threshold

Introduction

Today, smile attractiveness is the main reason for patient visits to orthodontists [1, 2]. It may not be appropriate to treat everyone in the same way, and it is necessary to consider the viewpoints of the members of each community on smile esthetics [3]. Orthodontists expect patients to emphasize some esthetic criteria more than others [4]. Therefore, it is important to determine the acceptable esthetics threshold for different criteria. The threshold is the least amount of beauty acceptable to a person and the point at which a person's diagnosis of deviation from the ideal begins. Parrini presented these thresholds in a systematic review in 2016 [5]. Despite the many studies on smile esthetics, there are very limited studies on the interference between beauty variables [6]. A combined study by Kaya *et al*. in 2013 investigated the effect of the smile arc in combination with the gingival display on smile attractiveness. The results showed that the smile arc and gingival display affect each other in determining the esthetics threshold [7]. However, no study has yet examined the effect of the cant of the occlusal plane combined with the midline deviation. In 2019, this study examined the cant of the occlusal plane combined with the axial deviation of dental midline on smile attractiveness and studied the combined esthetics threshold for these two variables, in Zanjani (Iran) people. The study relied on the smile esthetics thresholds confirmed in previous studies.

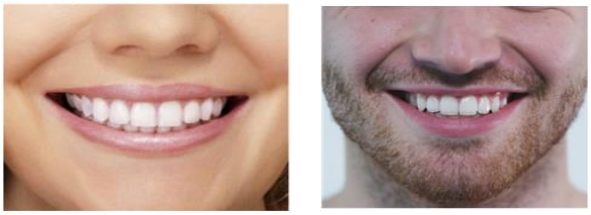
Access this article online	
Website: www.japer.in	**E-ISSN:** 2249-3379

How to cite this article: Sheikhi M, Asgari S. Influence on smile attractiveness of occlusal plane cant in conjunction with axially dental midline deviation. J Adv Pharm Educ Res. 2022;12(4):97-101. https://doi.org/10.51847/8yylcq3Zwv

Materials and Methods

Frontal photos of a woman and a man showing the lips in an ideal smile and perfectly straight teeth were downloaded from the Internet **(Figure 1)**. The selected photos were transferred to Photoshop CC 2017 software and trimmed to show the smile area (including the lips) so that the tip of the nose could be seen, and the midline could be identified, too. Changes were made to

both images so that the teeth could be moved independently of the lips.

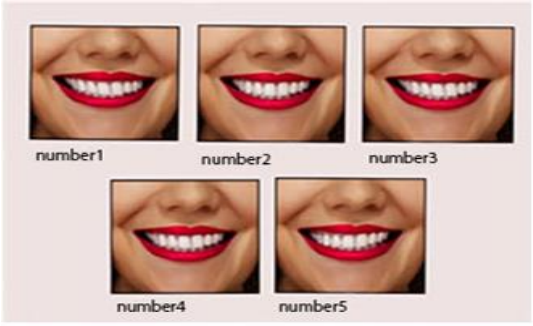


a) b)

Figure 1. Frontal image of a man and a woman with an ideal smile

The esthetics threshold for the cant of the occlusal plane for laypersons is 4° according to previous studies [8], and the esthetics threshold for axial midline deviation is 10° [9-11]. The changes in the first photo (both the woman's and man's photos) were such that the subject (the studied photo) did not have a cant but had a 10° midline axial deviation. Then, the changes were applied at 1° for cant and 2.5° intervals for the midline, and the photos were randomly placed on the questionnaire **(Table 1 and Figure 2)**. The criterion for the cant was the angle between the line that connects the most gingival point of the lateral incisors' crowns with the line that connects the commissures. This line was rotated around the center of the line connecting the laterals to create the cant of dentition. The midline criterion was the vertical line from the center of the philtrum, with which the midline had to be perfectly parallel. Midline deviation and cant were performed only in one direction because, according to previous studies, the direction of midline deviation does not affect people's judgment [12].

a)



b)

Figure 2. Patients 1 to 5 (man and woman) with applied Photoshop changes.

Table 1. The changed cant and midline angles from the first to fifth images

Image (patient) number before arranging in the questionnaire	Cant angle in degrees	Midline axial deviation angle in degrees	Image arrangement, ordering in the questionnaire
Image 1	0	10	1
Image 2	1	7.5	3
Image 3	2	5	4
Image 4	3	2.5	2
Image 5	4	0	5

Subsequently, 240 people aged ≥21 years (120 men and 120 women) demanding routine dental treatments in clinics or private offices in Zanjan were selected. Informed consent forms were obtained. A questionnaire that explained the study goals and included the subjects' demographic data, including age, sex, and level of education, was submitted to them, along with the modified photographs. The subjects wishing to participate in the study filled out the form. Sixty men evaluated the male subject's photos, and another 60 evaluated the photos of the female subject. Also, 60 female participants evaluated the male subject's photos, and 60 female participants evaluated the photos of the female subject. Under each image, a 4-point Likert scale was placed for the observer to evaluate each image separately as follows.

1) perfectly proportionate; 2) almost proportionate; 3) almost disproportionate; 4) very disproportionate.

In addition, the participants expressed their opinion about the need for treatment for each image as a question with a yes/no answer.

The data were analyzed with SPSS 23. Percentages and frequencies were used to describe the values. The chi-squared test was used to compare the results. An 0.05 significance level was considered.

Results and Discussion

The highest treatment needs percentage was reported for the first image with 10° midline axial deviation and 0° cant, with at least 86% of the participants believing that treatment was necessary. The lowest treatment need was reported for the second image with 2.5° midline axial deviation and 3° cant **(Table 2)**.

Table 2. Comparison of the participant's viewpoint of the treatment need for female and male photo

Image number	gender of the photos	Percentage of participants (number of participants)	
		Treatment need	No treatment need
1	female	86(104)	13(16)
	male	87(105)	12(15)
2	female	12(15)	87(105)
	male	11(14)	88(106)
3	female	56(68)	43(52)
	male	37(45)	62(75)

4	female	29(35)	70(85)
	male	13(16)	86(104)
5	female	64(77)	35(43)
	male	50(61)	49(59)

Analyzing the opinion of women and men specifically about the treatment needs showed that the treatment needs percentage in the photos of the woman was higher than that of the man. A high percentage of female participants reported that treatment was needed (95%) for the first image. In contrast, men were less likely to believe that treatment was necessary. Image 2 was reported to need the least treatment.

Evaluation of the participants' viewpoints, in terms of gender, about the photos of the woman showed that the difference was significant only in the first image (P=0.004). However, concerning the photos of the man, the difference was not statistically significant in any of the photos **(Tables 3 and 4)**.

Table 3. People's views on the image of women in terms of the gender of the judges

Female image number	Gender of participant	Percentage of participants (number of participants)				P_ value
		perfectly proportionate	Almost proportionate	almost disproportionate	very disproportionate	
1	female	0(0)	8(5)	55(33)	36(22)	0.004*
	male	8(5)	21(13)	36(22)	33(20)	
2	female	50(30)	45(27)	5(3)	0(0)	0.190
	male	46(28)	50(30)	0(0)	3(2)	
3	female	8(5)	43(26)	33(20)	15(9)	0.724
	male	16(10)	40(24)	25(15)	18(11)	
4	female	23(14)	58(35)	16(10)	1(1)**	0.269
	male	30(18)	45(27)	15(9)	10(6)	
5	female	15(9)	23(14)	46(28)	15(9)	0.681
	male	23(14)	31(19)	33(20)	11(7)	

*Significant

** Decimal numbers are omitted

Table 4. People's views on the image of men in terms of the gender of the judges

Male image number	Gender of participant	Percentage of participants (number of participants)				P_ value
		perfectly proportionate	Almost proportionate	almost disproportionate	very disproportionate	
1	female	3(2)	11(7)	51(31)	33(20)	0.723
	male	1(1)*	31(19)	41(25)	25(15)	
2	female	35(21)	56(34)	8(5)	0(0)	0.394
	male	26(16)	66(40)	6(4)	0(0)	
3	female	15(9)	50(30)	30(18)	5(3)	0.109
	male	18(11)	53(32)	23(14)	5(3)	
4	female	43(26)	50(30)	3(2)	3(2)	0.774
	male	38(23)	53(32)	0(0)	8(5)	
5	female	30(18)	33(20)	30(18)	6(4)	0.438
	male	21(13)	41(25)	25(15)	11(7)	

* Decimal numbers are omitted

In the present study, in the five images evaluated, two angles were modified; the angle of the occlusal plane cant and the midline axial deviation. The upper half of the face was removed in the studied images because the upper half of the face might affect the observers' evaluation of the smile's attractiveness inadvertently [7]. Also, in the changes made in the subjects' images, the most pleasant (0° cant and 0° midline deviation) or the most unpleasant cases (4° cant and 10° midline deviation) were ignored. This reduced the number of images to five. Reducing the number of images prevents the observers from fatigue, reluctance, and a decrease in the accuracy of the real critique of the images [7]. The acceptable threshold is the least level of esthetics that is acceptable). Therefore, in the present study, the need for treatment was considered as a criterion for lack of harmony in terms of esthetics, which is not acceptable by the observer, and lower values (more proportionate cases) were acceptable to the observers, with no need for treatment for esthetics. The variables of this study exhibited normal distribution. An interval of one standard deviation was considered for confirming the beauty of the studied population. In other words, a photo was considered acceptable when at least 68% of the participants confirmed its beauty. In other words, a subject (i.e., a photo) was confirmed to need treatment when >32% of the participants reported the need for

treatment. According to the results, photo 4 (having 2° cant and 5° axial deviation of the midline) in women and men can be considered as a threshold because if the mentioned angle changes in the previous photo (i.e., the third photo), the percentage of the treatment need will increase significantly.

The first photo (10° midline deviation) was reported to need treatment more than the fifth photo (4° cant). On the other hand, for the second photo, which had more cant than the fourth photo but less midline deviation, had a lower percentage participants reporting the need for treatment. It seems that the midline axial deviation has a more significant effect on treatment needs than the occlusal plane cant. Few studies have investigated the effect of maxillary midline axial angle on esthetic appearance. This inappropriate midline angle might not attract attention clinically due to the asymmetrical incisal edge abrasion [13]. However, Kokich *et al*. studied the angle of incisor crowns by changing the axial angle of the anterior teeth in the photograph of a smiling face and concluded that all the studied groups identified a 2-mm deviation in the midline axial angle [14]. A simple mathematical calculation shows that a 2-mm deviation is approximately equal to 11° of axial deviation, which almost corresponds to the threshold reported by previous studies. Therefore, it might be preferable in orthodontic esthetic treatments for the midline axial angle correction to take precedence over the occlusal plane angle.

In examining the cant of the occlusal plane alone, 0° cant is preferable. However, in the present study, the image with the lowest treatment need, i.e., the best image, had a 3° occlusal plane cant. Nonetheless, image 5, with a 4° cant and no midline deviation, needed treatment from the viewpoint of a high proportion of participants. Therefore, a combination of esthetic parameters might give rise to differences in acceptance than the results of accepting each criterion alone[15]. Therefore, perhaps it might be claimed that for correcting the cant, which is not accepted by the patient if a slight axial midline deviation is inevitably created, the aesthetic results will still be accepted by the patient. Kaya *et al*. showed that the participant's perception of the most attractive curve of the smile arc varies with changes in the gingival display and vice versa; i.e., the perception of the most attractive and proportionate gingival display will vary with changes in the curve of the smile arc [7].

Most previous studies, such as that by Onschal *et al.*, have assessed individuals' overall views [16]. Syed *et al*. examined only female perspectives [17]. However, in the present study, to evaluate people's views more accurately, both men and women were separately evaluated in four groups. In general, the treatment need percentage of female images was higher than male images, and it seems that the beauty of a woman's smile is more important from both men's and women's perspectives. A study in 2003 by Thomas *et al*. showed that the gender of the images played a significant role in the attractiveness of the modified images, but the judges' gender differences did not [13]. In the present study, the observers gave lower scores to the attractiveness of the females' images, and the results showed a lower acceptance threshold of the females' images than the males' images. It seems that midline axial deviation is less tolerable in women than in men. A similar result was reported by Beyer *et al*. who mentioned that after the lateral deviation of the midline, a lower acceptance threshold was obtained in females' images than in males'[18]. These results can be consistent with the idea that people generally think more critically about physical attractiveness in women. Another explanation is the attractiveness of the selected images themselves. Facial photographs are commonly used to evaluate individuals psychologically and socially and in other dental studies. It has been shown that judging by photographs seems relatively reasonable compared to the individual's real appearance. However, the selected image of a man might seem more attractive to people than the image of a woman, which is one of the disadvantages of using facial photographs in orthodontic studies [13].

The female participants in this study had a more accurate and insightful view of the smile aesthetics than the male participants. Dunn *et al*. reported results similar to the present study, with women making more definitive judgments about dental esthetics than men [19]. Therefore, it is better to be more accurate and cautious in designing esthetic treatments for women than men for improving and correcting the smile line.

Conclusion

From the Zanjani people's point of view, the esthetic threshold for combining the occlusal plane and the midline axial deviation is 2° of cant and 5° of midline deviation. In judging the beauty of a smile, the midline angle deviation is more important than the occlusal plane deviation. Women have a more accurate and insightful view of the beauty of a smile than men.

Limitations

The threshold for acceptability of axial deviation has been 10 in previous studies; however, opinions about beauty vary in different societies so at least 86% of the Zanjan people believed that this amount of midline axial deviation needs treatment. This means that the threshold for midline axial deviation might be<10 for the Zanjan people, which might be attributed to the more critical view of the Zanjan people about facial beauty. However, this different threshold affected the results of the present study, leading to the ambiguity of the combined threshold determination.

In this study, we studied the angular changes of cant and midline incrementally to reduce the number of images and consistent with other studies. Therefore, there are other angles between the two increments that have not been studied; for instance, 1.5° cant with the midline deviation angle of 6.5° might also not be considered "to need treatment" by the participants and be considered as a threshold that was not studied in this study.

The data reliability of such studies depend on time, cultural, and social changes, and might not be extended to other societies or times.

Suggestions

It is recommended that studies be conducted in Zanjan to determine the esthetics threshold for the various characteristics affect the smile.

It is recommended that these studies be repeated at regular intervals in other communities, too. However, other studies are necessary to determine this time interval.

Similar studies should be performed but with smaller increments.

Acknowledgments: We would like to appreciate Dr. Nima Motamed for undertaking statistical consultation of this research.

Conflict of interest: None

Financial support: None

Ethics statement: This article was extracted from the results of a thesis, for a degree in general dentistry. The Ethics Committee of Zanjan Medical Sciences University approved this study under the code IR.ZUMS.REC.1398.419.

References

1. Cotrim ER, Vasconcelos Júnior ÁV, Haddad AC, Reis SA. Perception of adults' smile esthetics among orthodontists, clinicians and laypeople. Dental Press J Orthod. 2015;20(1):40-4.
2. Machado AW, Moon W, Gandini LG Jr. Influence of maxillary incisor edge asymmetries on the perception of smile esthetics among orthodontists and laypersons. Am J Orthod Dentofacial Orthop. 2013;143(5):658-64.
3. Al Taki A, Khalesi M, Shagmani M, Yahia I, Al Kaddah F. Perceptions of altered smile esthetics: A comparative evaluation in orthodontists, dentists, and laypersons. Int J Dent. 2016;2016(7815274):1-11.
4. AlShuaibi M, Maneea AB, Almarshd A, AlShuaibi H, AlAmassi B. Ethical Dilemma and Controversies over Cosmetic Laminate Veneers among Dentists in Riyadh. Pharmacophore. 2021;12(4):79-85.
5. Parrini S, Rossini G, Castroflorio T, Fortini A, Deregibus A, Debernardi C. Laypeople's perceptions of frontal smile esthetics: A systematic review. Am J Orthod Dentofacial Orthop. 2016;150(5):740-50.
6. Verma P, Dinesh S. Perception of Smile Aesthetics as Influenced by Gingival Margin Asymmetries of Maxillary Canine among Different Specialities. Ann Dent Spec. 2021;9(3):60-4.
7. Kaya B, Uyar R. Influence on smile attractiveness of the smile arc in conjunction with gingival display. Am J Orthod Dentofacial Orthop. 2013;144(4):541-7.
8. Proffit WR, Fields Jr HW, Sarver DM. Contemporary orthodontics. Elsevier Health Sciences; 2006.
9. Johnston CD, Burden DJ, Stevenson MR. The influence of dental to facial midline discrepancies on dental attractiveness ratings. Eur J Orthod. 1999;21(5):517-22.
10. Menezes EBC, Bittencourt MAV, Machado AW. Do different vertical positions of maxillary central incisors influence smile esthetics perception? Dental Press J Orthod. 2017;22(2):95-105.
11. Öz AA, Akdeniz BS, Canlı E, Çelik S. Smile Attractiveness: Differences among the Perceptions of Dental Professionals and Laypersons. Turk J Orthod. 2017;30(2):50-5.
12. Silva BP, Jiménez-Castellanos E, Stanley K, Mahn E, Coachman C, Finkel S. Layperson's perception of axial midline angulation in asymmetric faces. J Esthet Restor Dent. 2018;30(2):119-25.
13. Thomas JL, Hayes C, Zawaideh S. The effect of axial midline angulation on dental esthetics. Angle Orthod. 2003;73(4):359-64.
14. 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):311-24.
15. Alhussain BS, Almanea MY, Alharbi AN, Alali MS, Alraba MA, Alferm OB. Use of Lasers in Oral Maxillofacial Surgery; a cross-sectional study done in Riyadh, Saudi Arabia. Arch Pharma Pract. 2021;12(4):77-83.
16. Ousehal L, Aghoutan H, Chemlali S, Anssari IF, Talic N. Perception of altered smile esthetics among Moroccan professionals and lay people. Saudi Dent J. 2016;28(4):174-82.
17. Syed S, Al Shahrani I, Togoo R, Alshahrani A, Alshahrani A, Alshehri D. Esthetic perception of maxillary midline diastema among female students at King Khalid University. Gulf Med J. 2017;6(10):49-54.
18. Beyer JW, Lindauer SJ. Evaluation of dental midline position. InSeminars in orthodontics 1998 Sep 1 (Vol. 4, No. 3, pp. 146-152). WB Saunders.
19. Dunn WJ, Murchison DF, Broome JC. Esthetics: patients' perceptions of dental attractiveness. J Prosthodont. 1996;5(3):166-71.