

To Evaluate the Impact of Canine Inclination on Smile Esthetics: A Photographic Study

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ABSTRACT

Background: Nowadays, facial attractiveness plays an important role in our daily social interactions. An appealing smile is generally associated with a person's positive character and a higher social position. Hence, it is not surprising that a patient's dental appearance considerably affects his or her quality of life and well-being. The objective of the study is to: a) Analyze the value of upper canine inclination perceived to be most attractive. b) Determine the most aesthetic inclination of canine in the frontal view of a smile and correlate it with other facial features. c) Determine if the orthodontists, dentists and laypersons appreciate differently canine inclination in smile esthetics. 1 Male and one female sample (non-growing age group) were chosen from Patna Dental College representative of North Indian population, having good facial proportions with skeletal and dental class I. The subjects having harmonious high smile line were chosen. Frontal smiling photographs were taken with a DSLR camera. The analysis showed that the most attractive image was the (0 degree), followed by inward inclination than outward inclination in both the sexes as analyzed by all three groups of raters. Participants perceived smiles to be most attractive when the upper canine tooth axis is parallel to the imaginary line formed by the lateral canthus and the ipsilateral labial angle (0 degrees), or a slight inward canine inclination is perceived to be more attractive than outward inclination.

Keywords: Digital photographs, DSLR camera, canine inclination, perception, Full face and Lower third face frontal face photographs.

INTRODUCTION

Smiling is the most common facial expression used to express friendliness, agreement, and appreciation. It is no surprise that improving smile attractiveness is a major driving force encouraging patients to seek oral care, and correspondingly, is also a principal objective of orthodontic treatment.¹

The importance of obtaining an ideal smile is considered to be one of the prime goals of orthodontic treatment. Smile analysis is based on multiple aspects including macro, mini and micro-aesthetics such as gingival display, crown length,

maximum incisor exposure, smile arc, the width of the buccal corridor space etc.² A survey showed that 80% of adults seeking orthodontic care for themselves or their children are motivated by the desire to improve facial attractiveness, regardless of structural and functional considerations.³ Earlier, diagnosis and treatment planning were focussed only on skeletal and dental hard tissue elements. The emerging importance of soft tissue function and aesthetics has created a paradigm shift in diagnosis and treatment planning for orthodontic treatment.⁴⁻⁶

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Treatment planning is very essential for an orthodontist to analyze the complete profile of the patient, at rest and as well as during function. Smile is an important component in overall dentofacial aesthetics and has to be assessed in static as well as dynamic function. Thomas et al. conducted a study to evaluate the effect of axial midline angulation on the attractiveness of a smile altering female and male smiling photographs. The photos were altered to produce both left and right axial midline angulations in 5-degrees increments. The author concluded that attractiveness scores and acceptability ratings declined consistently as axial midline angulation increased.⁷⁻⁸

Bothung et al. investigated which angle of canine inclination (angle between canine tooth axis (CA line) and the line between the lateral canthus and the ipsilateral labial angle (EM line) is perceived to be most attractive in a smile. Two sets of images (1 male model set and 1 female model sets) each containing seven images with incrementally altered canine and posterior tooth inclination, were generated. The images were ranked for attractiveness by three groups (61 Laymen, 59 Orthodontists, 60 Dentists). The authors concluded that smiles were perceived to be most attractive when upper canine tooth axis was parallel to the EM line. In reconstructive or, orthodontic therapy, it is thus important to incline canines more inwardly than outwardly.⁹

This study utilizes 1 Male and 1 Female sample (non-growing age group) chosen from Patna Dental College and Hospital, Patna having good facial proportion with skeletal and dental class I. The subjects have a harmonious high smile line revealing 100% of anterior maxillary teeth and some amount of gingival exposure. Frontal smiling photographs were taken with a DSLR camera in the natural head position. Full facial smile photographs and lower third smile photographs were taken.

MATERIALS AND METHODOLOGY

Sources of Data

1 Male and 1 female (non-growing age group) sample were chosen from Patna Dental College, having balanced facial proportions with skeletal and dental class I. The subjects having a harmonious high smile line revealing 100% of maxillary anterior

teeth and some amount of gingival exposure were chosen.

Method of data collection:

Frontal smiling photographs were taken with a DSLR camera in the natural head position. Full facial frontal smile photographs and lower facial third smile photographs were taken with DSLR Camera (NIKON Model no.3400) Standardization of photograph: The ideal position for the camera is when the line of the central lens to the eyes is parallel with the horizontal plane and when the lens is centred between both eyes. Distance between the subject and the camera is maintained at 180cm or 6 feet. Informed consent was obtained from the subjects before taking their facial photographs.

Raters:

Three groups of raters were selected.

- The first group consisted of 20 Orthodontists.
- The second group consisted of 20 General Dentists selected randomly from Patna.
- Third group consisted of 20 laypersons (age group 20 to 40 years) selected among patients visiting the department.

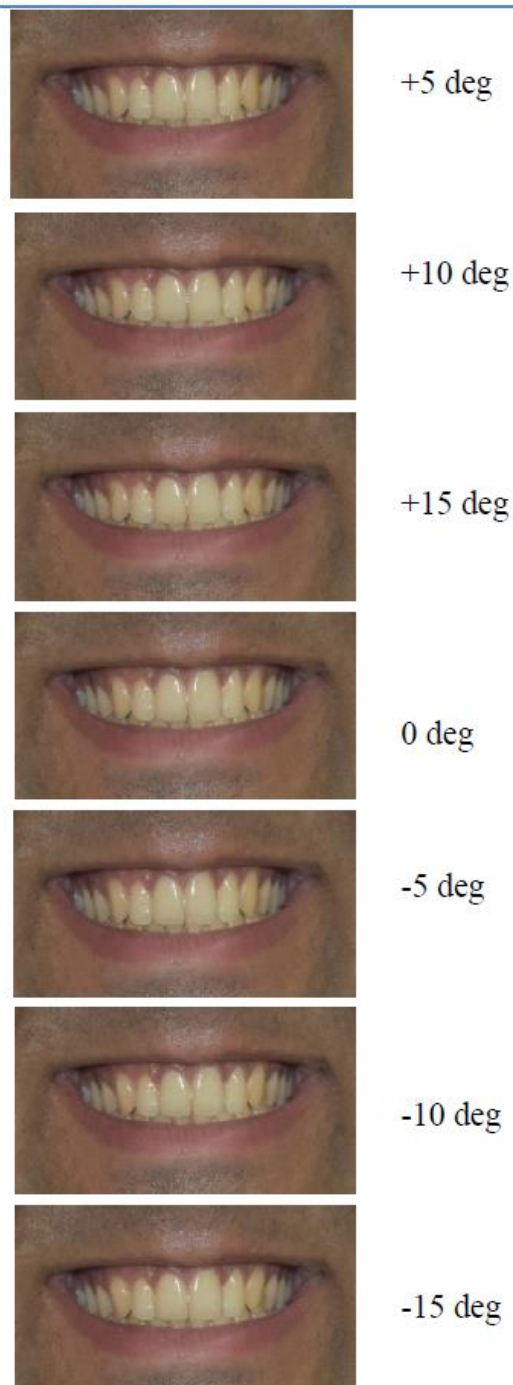
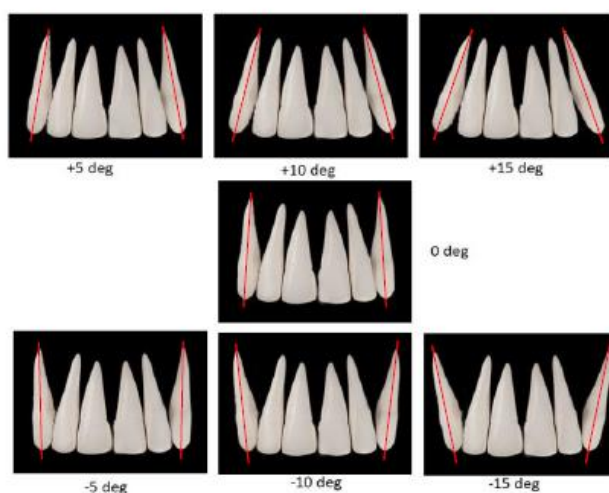
Inclusion Criteria:

Frontal smiling face image:

- A. Permanent dentition without retained deciduous teeth.
- B. Class I occlusion with normal overjet and overbite.
- C. Hard and soft tissues within normal limits as determined by cephalometric analysis.
- D. Harmonious high smile.

Procedure: A color photograph of each subject was taken in natural head position. Frontal facial full-face smile photographs and lower facial third smile photographs were obtained using a DSLR camera. The photographs are altered using image editing software available, Adobe Photoshop CS 6.

Method of displaying: Photographed images were edited by using photograph editing software Adobe Photoshop CS 6. All altered images were projected on the screen and each rater was given an evaluation form having VAS (1-10) and were asked to rate images on the basis of attractiveness.



The time duration between each slide was 10 second, and raters were not allowed to go back to the previous slides in order to eliminate bias. Artistic editing was used to maintain a natural appearance when necessary. All images were cropped into the full face or lower facial third photographs of the same size. Raters were instructed to compare the altered image with the original image. Each photograph was fixed with a 10 points visual analogue scale. The visual analogue scale was evaluated by the raters as least attractive

(0-2), moderate attractive (3-5), attractive (6-7) and most attractive (8-10).

For canine: The ideal images of a male and female subject were further altered into six images with differential inclination angles. The angle of inclination is defined by the angle between the canine axis (CA Line) and the line between the lateral canthus and the ipsilateral labial angle (EM Line).⁹⁻¹⁰ An angle of 0 degree means two lines are parallel. The changes were made in degree angle

increment. The created sets were composed of images with +15-degrees, +10 degrees and +5 degrees outward inclination and -5 degrees, -10 degrees, -15 degrees inward inclination of the canine. The ideal image with 0-degree inclination completes each set. All the seven images were fixed with a 10 points visual analogue scale and rated by the raters.

Recording of the Data

All the seven images of canine of full face and the facial third was projected. Ten points visual analogue scale (VAS) rating form was provided for each image, and raters were asked to evaluate the attractiveness of the smile images. Separate forms were given for male and female samples.

RESULTS

In the present study, all the scores obtained by evaluations were tabulated by using MS Excel and subjected to statistical analysis using SPSS 19.0 Software.

Maxillary Canines

Table 1 and 2 depicts the inclination of canines of male and female respectively and the inclination perceived by three groups of raters as most attractive and least attractive, undeviated angle (0 degrees) was perceived to be most attractive by 45% of orthodontists, 47.6% of general dentists and 35% of laypersons, followed by -5 degrees, -10 degrees, and -15 degrees.

This suggested that inward canine inclination was found to be more attractive than outward inclination. Positive canine inclination (outward) was less attractive as none of the orthodontists perceived it to be attractive but 4.8% of general dentists and 15% of layperson perceived +5 degrees to be attractive, while for +10 degree only 5% of laypersons rated it as attractive.

There was no gender bias between all three groups of raters, and the order of attractiveness was found to be same with a slight change in percentages.

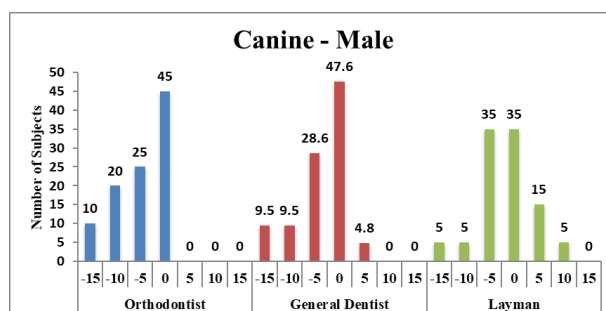
Table 1: Comparison of aesthetic perception by the raters - inclination of canine in male.

Angulation	Raters			Total	Fisher's Exact test p-value
	Orthodontist	General Dentist	Layperson		
-15	2 10.0%	2 9.5%	1 5.0%	5 8.2%	0.67(NS)
-10	4 20.0%	2 9.5%	1 5.0%	7 11.5%	
-5	5 25.0%	6 28.6%	7 35.0%	18 29.5%	
0	9 45.0%	10 47.6%	7 35.0%	26 42.6%	
5	0 0.0%	1 4.8%	3 15.0%	4 6.6%	
10	0 0.0%	0 0.0%	1 5.0%	1 1.6%	
15	0 0.0%	0 0.0%	0 0.0%	0 0.0%	
Total	20 100.0%	20 100.0%	20 100.0%	60 100.0%	

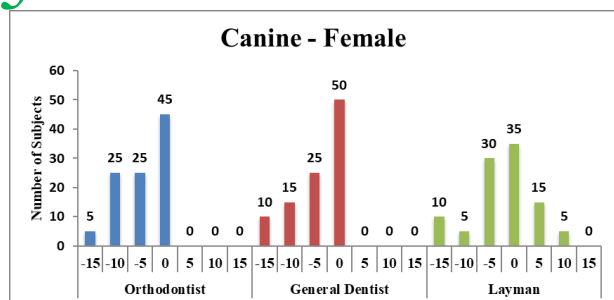
* $p < 0.05$ Statistically Significant,

Table 2: - Comparison of aesthetic perception by the raters - inclination of canine female

Angulation	Raters			Total	Fisher's Exact test p-value
	Orthodontist	General Dentist	Layperson		
-15	1 5.0%	2 10.0%	2 10.0%	5 8.3%	0.43(NS)
-10	5 25.0%	3 15.0%	1 5.0%	9 15.0%	
-5	5 25.0%	5 25.0%	6 30.0%	16 26.7%	
0	9 45.0%	10 50.0%	7 35.0%	26 43.3%	
5	0 0.0%	0 0.0%	3 15.0%	3 5.0%	
10	0 0.0%	0 0.0%	1 5.0%	1 1.7%	
15	0 0.0%	0 0.0%	0 0.0%	0 0.0%	
Total	20 100.0%	20 100.0%	20 100.0%	60 100.0%	



Graph 1: Inter group Comparison of Aesthetic Perception by Raters - Inclination of Maxillary Canines (Male).



Graph 2: - Intergroup Comparison of Aesthetic Perception by Raters - Inclination of Maxillary Canines (Female)

DISCUSSION

The position of maxillary canines in all three dimensions is a fundamental component of an attractive smile.¹¹ In this study, the effect of the inclination of the maxillary canines on the esthetic evaluations and related factors were evaluated.

Because an attractive smile is a primary goal for orthodontic treatment, the precise orthodontic positioning of the maxillary canines should never be underestimated in obtaining an ideal orthodontic outcome.¹²⁻¹³ A better understanding of the acceptable range for the inclination of the maxillary canines plays an important complementary role in achieving the desired facial harmony.¹⁴ In this study, the factors that interfere with esthetic perceptions associated with the inclination of the maxillary canines were controlled.

Participants perceived smiles to be most attractive when the upper canine tooth axis was parallel to the imaginary line formed by the lateral canthus and the ipsilateral labial angle. About 70% of the participants preferred images with parallelism between the canine tooth axis and the EM-line or a slight inward canine inclination of -5°.

These results confirm Rufenacht's theory, who proposed in his book 'Principles of aesthetic integration', that the canines should be integrated harmoniously into the face and its facial constraints (e.g. EM-line). Otherwise, a diminishing effect of the aesthetic value of the facial composition could be expected. In other words, a harmonious integration could also mean that a smiling mouth with an inherently consistent dentition only gains a small part of visual attention in well-balanced faces.

Upper canines are not only important for dynamic occlusion as required in gnathological concepts.¹⁵⁻¹⁶ They also serve as a transition point from the anterior to the posterior teeth. Furthermore, the upper canines, together with the central and lateral incisors, define the character of a smile. Rufenacht has suggested that the maxillary canine axis (CA-line) and the line formed by the lateral canthus and the ipsilateral corner of the mouth (EM-line) should be parallel (0° deviation) for a harmonious smile.¹⁷⁻¹⁹

In the present study, the raters who participated in the survey consisted of 20 Orthodontists, 20 General dentists and 20 Laypersons. Raters perceived smiles to be most attractive when the upper canine tooth axis was parallel to the image with 0-degree deviation (CA-line parallel to EM-line) and was ranked No. 1 by 45% Orthodontists, 47.6% of general dentists and 35% by the Laypersons followed by a slight inward angulation of -5 degrees which was perceived to be second most attractive than -10 degrees and -15 degrees. Thus, the result showed that inward inclination of canines is perceived to be more attractive than outward inclination (Table 1 and 2). This table also shows that there is no gender difference in the attractiveness scores given by all three groups of raters.

Kokich et al²⁰ ascertained that Laymen, Dentists and Orthodontists detect changes in smile characteristics at different threshold levels and that Laymen were the most forgiving.

However, the values were not significant as the laypersons are also educated nowadays and more concerned about their esthetics, and they can make out the changes as perceived by general dentists as well as Orthodontists but to a lesser extent.

CONCLUSION

The inclination of the maxillary canines can affect smile esthetics in the frontal view. The raters' professions did not affect their appreciation of incisor angulations. Lower facial third photographs were more objective and reliable than full-face photographs in dental esthetic evaluations. There was no gender bias in the esthetic perceptions of the inclination of the maxillary canines. Participants perceived smiles to be most attractive when the

upper canine tooth axis is parallel to the imaginary line formed by the lateral canthus and the ipsilateral labial angle. About 70% of the participants preferred images with parallelism between the canine tooth axis and the EM-line or a slight inward canine inclination of -5°. On the contrary, outward inclinations were perceived as disruptive to the aesthetic value of the facial composition and diminished the aesthetic appearance. In reconstructive or orthodontic therapy, it is thus important to incline canines more inwardly than outwardly.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

REFERENCES

1. Shuying Yang, Yunfei Guo, Xianrui Yang, Feng Zhang, Jian Wang, Jingyi Qiu, and Juan Lif Chengdu. Effect of mesiodistal angulation of the maxillary central incisors on esthetic perceptions of the smile in the frontal view. (Am J Orthod Dentofacial Orthop 2015; 148:396-404)
2. Vig RG, Brundo GC. The kinetics of anterior tooth display. J Prosthet Dent. 1978; 39:502-4.
3. Hulsey CM. An esthetic evaluation of lip-teeth relationships present in the smile. Am J Orthod. 1970; 57:132-144.
4. Sarver D.M. The importance of incisor positioning in the esthetic smile. Am J Orthod Dentofacial Orthop 2001;120(2):98-111
5. Chou JC, Nelson A, Katwal D, Elathamna EN, Durski MT. Effect of smile index and incisal edge position on perception of attractiveness in different age groups. J Oral Rehabil. 2016 Nov;43(11):855-862.
6. Sriphadungporn C, Chamnannidiadha N. Perception of smile esthetics by laypeople of different ages. Progress in Orthodontics. 2017;18(1):8.
7. Thomas JL, Hayes C, Zawaideh S. The effect of axial midline angulation on dental esthetics. Angle Orthod 2003; 73:359-64.
8. Thomas, M., Reddy, R. and Reddy, B.J. Perception Differences of Altered Dental Esthetics by Dental Professionals and Laypersons. Indian J Dent Res 2011; 22:242-247.
9. C. Bothung, K. Fischer, H. Schiffer, I. Springer & S. Wolfart; Upper canine inclination influences the aesthetics of a Smile. Journal of Oral Rehabilitation, 2014.
10. Gul-e-Erum, Fida M. Changes in smile parameters as perceived by orthodontists, dentists, artists, and laypeople. World J Orthod 2008; 9:132-40.
11. Rigsbee OH, Sperry TP, Be Gole EA, The influence of facial animation on smile characteristics. Int J Adult Orthod Orthognath Surg 1988;3;233-9.
12. Peck S, Peck L, Kataja M. The gingival smile line. Angle Orthod 1992;62(2):91-100.
13. Mackley J R. An evaluation of smiles before and after orthodontic treatment. Angle Orthod. 1993;63(3):183-190.
14. Zachrisson BU. Esthetic factors involved in anterior tooth display and the smile: vertical dimension. J Clin Orthod. 1998; 32:432-445.
15. Teixeira de Paiva, Ricardo Martins Machado, Alexandre Trindade Motta, and Claudia Trindade Mattos Rio de Janeiro. Influence of canine vertical position on smile esthetic perceptions by orthodontists and laypersons. (Am J Orthod Dentofacial Orthop 2018; 153:371-6)
16. Dickens S.T.; Sarver D.M.; Proffit W R. Changes in frontal soft tissue dimensions of the lower face by age and gender. World Journal of Orthodontics, Winter 2002;3 (4):313-320.
17. Ackerman MB, Ackerman J. Smile analysis and design in the digital era. J Clin orthod.2002;36:221-236.
18. Wolfart S, Brunzel S, Freitag S, Kern M. Assessment of dental appearance following changes in incisor angulation. Int J Prosthodont. 2004; 17:150-154.

19. Geron S, Atalia W. Influence of sex on the perception of oral and smile esthetics with different gingival display and incisal plane inclination. *Angle Orthod* 2005; 75:778-784.
20. Kokich VO Jr, Kiyak HA, Shapiro PA. Comparing the perception of dentists and lay people to altered dental esthetics. *J Esthet Dent* 1999; 11:311-24.
21. Pinho S¹, Ciriaco C, Faber J, MA. Impact of dental asymmetries on the perception of smile esthetics. *Am J Orthod Dentofacial Orthop.* 2007 Dec;132(6):748-53.
22. Nanda R., Burstone, C.J. JCO interviews: part 1. Facial esthetics. *J Clin Orthod.* 2007; 41:79-87.
23. Desai S, Upadhyay M, Nanda R. Dynamic smile analysis: changes with age. *Am J Orthod Dentofacial Orthop.*2009;136: 310. e1-10.
24. Nascimento D C, Santos E R, Machado A W L, Bittencourt, M A V. Influence of buccal corridor dimension on smile esthetics. *Dental Press Journal of Orthodontics* 2012;17(5):145-150.
25. Amjad Al Taki, Thar Hayder Mohammed, and Ahmad Mohammad Hamdan; Influence of the Smile Line on Smile Attractiveness in Short and Long Face Individuals. *International Journal of Dentistry.* Volume 2017, Article ID 2637148, 7 pages.