



Comparison of Maxillary Central Incisor, Crown Angulation and Tooth Size Variation in Aesthetic and Non-aesthetic Smiles- A Cross Sectional Study

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Abstract

Background: An attractive smile is often attributed to incisor alignment and proclined or retroclined incisors could contribute to a less aesthetic smile.

Objectives: This study was aimed to evaluate the maxillary central incisor crown inclination, crown angulation and tooth size variation in aesthetic and unattractive smiles.

Methods: The study was conducted among 100 females (equally divided into aesthetic and unaesthetic smile groups), aged between 15 - 25 years, with Angle's Class I normal occlusion and balanced profiles. Variations in maxillary central incisor crown inclination and angulation were measured on lateral cephalograms, photographs and the study models of the subjects. Variations in tooth morphology were also evaluated by measuring crown height and width in both groups. Mann-Whitney U test was performed to evaluate the difference between the aesthetic and unaesthetic smiles. $P < 0.05$ was considered as significant.

Results: This study showed that incisor angulation was significantly higher in the unaesthetic group compared to the aesthetic group ($P < 0.001$). However, there was no statistically significant difference for the incisor inclination relative to the Palatal Plane between the aesthetic and unaesthetic smile groups ($P = 0.086$). In addition, there were significant differences between the aesthetic and the non-aesthetic groups regarding the central incisor height ($P < 0.05$).

Conclusions: The findings of this study indicate that the possible variations in aesthetics are related to the ethnic elements that are associated with differences in crown angulations, as well as tooth size.

Keywords: Smile, Maxillary Incisors, Crown Angulations, Crown Inclinations

1. Background

Facial aesthetics is an integral part of one's personality and one of the major contributing factor in facial aesthetics is well aligned dentition. It is a fact that the speaker's eyes and mouth are attentively watched during normal social interactions (1). The position and inclination of the incisor teeth is not only prudent for an attractive smile, but also for normal masticatory function (2).

With the advent of six keys to occlusion by Andrews, it is widely acknowledged that normal occlusion is constituted by ideal incisor angulation and inclination (3). But what Andrew's considers as normal is not applicable universally due to racial and ethnic variations (4). The understanding that each and every individual requiring orthodontic treatment is different in unique ways should re-

frain the orthodontist from superimposing a standardized smile to all his patient (5). The extensive review of literature pertaining to this topic showed a paucity of research pertaining to the established norms of the incisor angulation and inclination among the Indian population. The confirmation of normal values for incisor crown angulation and crown inclination for each population and comparing them with Andrew's values will have a great impact on orthodontic treatment planning.

2. Objectives

The current study was performed in order to assess crown angulations and inclinations of the central incisors in the Indian population and to compare them with the normal values of other populations.

3. Methods

A cross sectional community-based study was performed on a sample of 100 females. Ethical clearance for the study was obtained from the Institute of Ethical Committee. On the basis of the results of the pilot study with the allowable error of 5%, keeping the power of the study at 80%, the sample size obtained included 45 subjects in each group. Keeping this in mind, the final sample was kept at 50 individuals per group. Two samples were obtained in two stages. In the first stage, 200 female college students of 15 - 25 years were selected on the basis of the pre-set selection criteria using the simple random technique. All subjects had well balanced facial profile with Angle Class I molar and canine relationships along with normal overjet and overbite. They had no history of past orthodontic treatment, all the hard and soft tissue intra oral features were normal with no visible signs of caries, periodontal disease, fracture or any restorations in relation to the anterior teeth. And there was no evidence of attrition or abrasion of the teeth.

The subjects were informed about the study and a consent was obtained for their participation. Smiling photograph of all 200 subjects were shown to 50 lay people (25 males and 25 females) within the span of 8 days and they were asked to rank the smile on the VAS scale of 1 - 10 scoring. Scores 1 to 5 were graded as unaesthetic smiles and scores 6 - 10 were graded as aesthetic smiles. The judges were shown the power point slide show in a seminar hall with the photographs cropped to 4" × 6" size displaying only the smile of the subjects. Each photograph was shown for the span of a minute and the judges were given the survey form containing the VAS scale to judge the smile attractiveness.

All judges were lay people who worked in a technical institution. Fifty top scored photographs were chosen as the aesthetic smile group and the fifty low scored photographs were categorised as the unaesthetic smile group. In the second stage, the lateral cephalograms, intra-oral periapical radiographs, posed smile photographs and study models were evaluated in both groups for the positional evaluation of the maxillary central incisors.

Lateral cephalograms of each patient was obtained in the centric occlusion with lips in a relaxed position with the Frankfort horizontal plane parallel to the floor in the natural head position (NHP). Cephalometric radiographs were hand-traced in a dark room using a 4H pencil on acetate tracing paper using X-ray viewer by a single examiner. For measuring the angles, the measurements were kept to the nearest 0.5 degree. The essential soft tissue and hard

tissue structures were pointed on the cephalometric radiographs and the angular measurements such as incisor inclination were measured as mentioned below:

- Upper incisor to SN-plane (the angle between the long axis of upper central incisor and the SN plane).

- Upper incisor to Palatal Plane (the angle between the long axis of upper central incisor and the Palatal Plane) (Figure 1).

Proper maxillary plastic impression trays (Leone, Italy) were selected and the impressions were obtained using elastomeric impression material (Flexceed, GC, Singapore). Impressions were rinsed under running water to remove any debris or exudate, then the impressions were immersed in glutaraldehyde solution for 20 minutes. After that, the impressions were rinsed under running water once more in order to remove the disinfectant. Ortho-cal stone plaster was then poured into the impressions. A digital caliper was used to measure the crown height and width of the central incisors on the study models.

Intra-oral periapical radiographs were taken by angle bisecting technique using Corix® Pro 70 Vet Dental X-Ray with the projection of central ray through the tip of the nose towards the middle of the film with approximately +45° vertical angulation and 0° horizontal angulation. The patients' heads were adjusted so that the occlusal plane was horizontal to the floor (6). Bisecting angle technique was used in this study to obtain accurate angulation of the incisors. Superior points of the incisal edge (ISI: incision superius incialis) and apical point (ISA: incision superius apicalis) were marked, then they were joined to get the long axis of the incisors. Incisor angulation was considered as the angle between the long axis of clinical crown of the upper central incisor and line perpendicular to the incisor plane (Figure 2).

A photograph of a posed smile of participants was taken with the SLR D20 Camera (Sony, Japan) at the distance of 5 feet. Crown angulation of maxillary central incisor was evaluated manually on a printed photograph sized 4" × 6". The perpendicular line to the incisal plane was constructed and the angle between this line and long axis of facial crown was measured (Figure 3). All measurements were done manually by one observer.

To evaluate the intra-examiner variability, data was collected twice for ten subjects with a 10-day interval and was subjected to the kappa statistics. Kappa accounted for 90%. Using the SPSS version 22, Mann-Whitney U test was performed in order to assess the dissimilarities between the aesthetic and unaesthetic smiles. P-value < 0.05 was considered as significant.

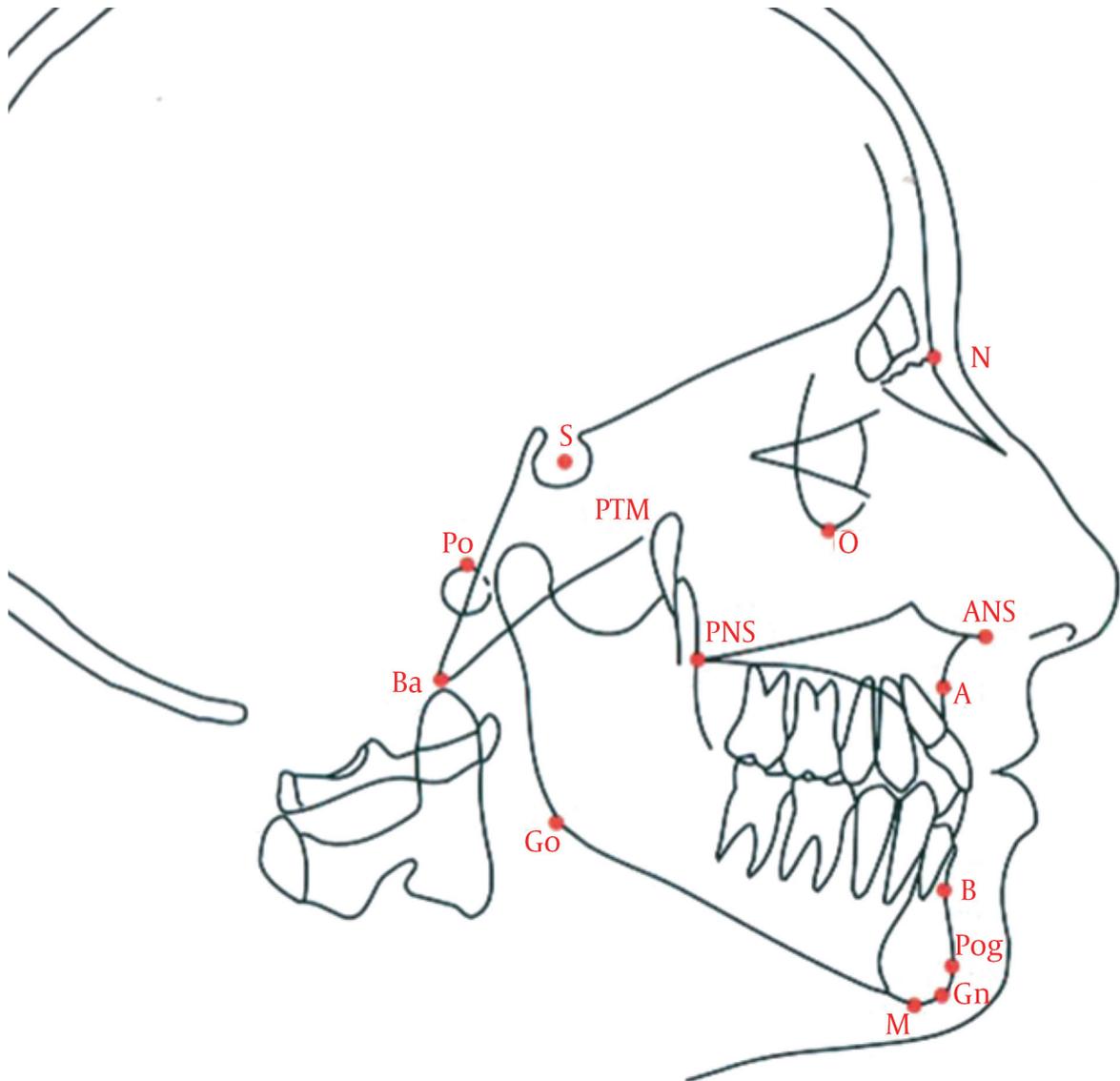


Figure 1. Cephalometric landmarks used in this study

4. Results

Table 1 shows the incisor inclination angle measured on lateral cephalograms among the aesthetic and the unaesthetic groups. Mann-Whitney U test showed that incisor angulation was significantly higher in the unaesthetic group compared to the aesthetic group ($P < 0.001$). Nevertheless, there was no statistically significant variance in the incisor inclination relative to the Palatal Plane between the aesthetic and the unaesthetic smile groups ($P = 0.086$).

The comparison of the crown height and width of right and left central incisors between the aesthetic and unaesthetic smile groups is depicted in Table 2. There were significant differences between aesthetic and non-aesthetic groups regarding the central incisors height ($P < 0.05$).

However, there was no significant difference between the aesthetic and unaesthetic smile groups for the crown width of the right and left central incisors.

The comparison of right and left central incisor angulation between aesthetic and non-aesthetic groups is shown in Table 3. Right and left central incisor angulation mea-

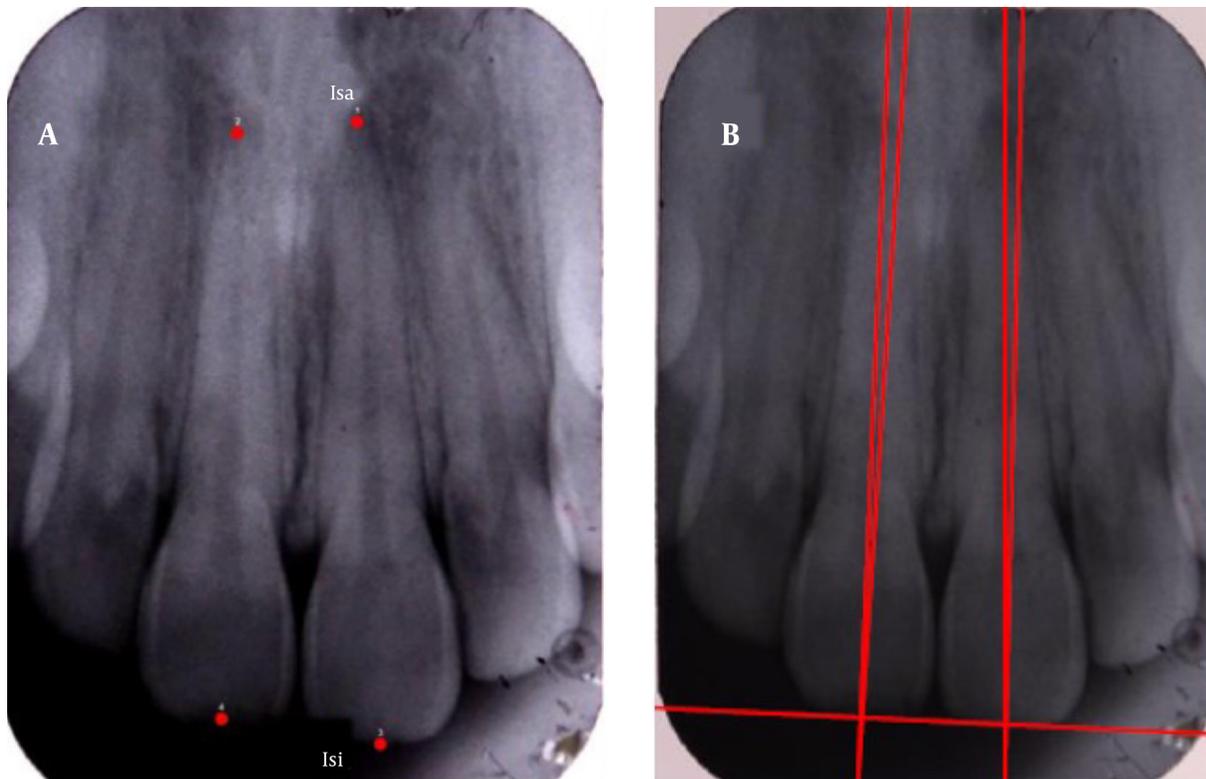


Figure 2. Measurement of incisor angulation in PA radiographs

Table 1. Comparison of Incisor Inclination Angle on Lateral Cephalograms Between Aesthetic And Unaesthetic Groups

Parameters	Aesthetic Smile Group			Unaesthetic Smile Group			Mann-Whitney U Test (P Value)
	Mean \pm SD	Median	Min-Max	Mean \pm SD	Median	Min-Max	
Incisor angulation ($^{\circ}$)	107.80 \pm 2.08	108	105 - 112	117.52 \pm 14.53	114	103 - 178	< 0.001 ^a
Incisor inclination ($^{\circ}$)	61.08 \pm 6.61	60	47 - 73	56.64 \pm 8.32	57	41 - 69	0.086

^a Significant at P < 0.001.

Table 2. Comparison of Central Incisor Crown Height and Width Between the Aesthetic and Unaesthetic Smile Group

Parameters	Aesthetic Smile Group			Unaesthetic Smile Group			Mann-Whitney U Test (P Value)
	Mean \pm SD	Median	Min-Max	Mean \pm SD	Median	Min-Max	
Crown Height							
Right central incisor	9.36 \pm 0.82	9.50	8 - 12	10.04 \pm 0.80	10	8.50 - 11.50	0.004 ^a
Left central incisor	9.38 \pm 0.83	9.50	8 - 12	10.00 \pm 0.83	10	8.50 - 11.50	0.011 ^a
Crown Width							
Right central incisor	8.28 \pm 0.50	8	8 - 10	8.48 \pm 0.51	8.50	7.50 - 10.00	0.051
Left central incisor	8.28 \pm 0.50	8	8 - 10	8.48 \pm 0.51	8.50	7.50 - 10.00	0.051

^a Significant at P < 0.05.

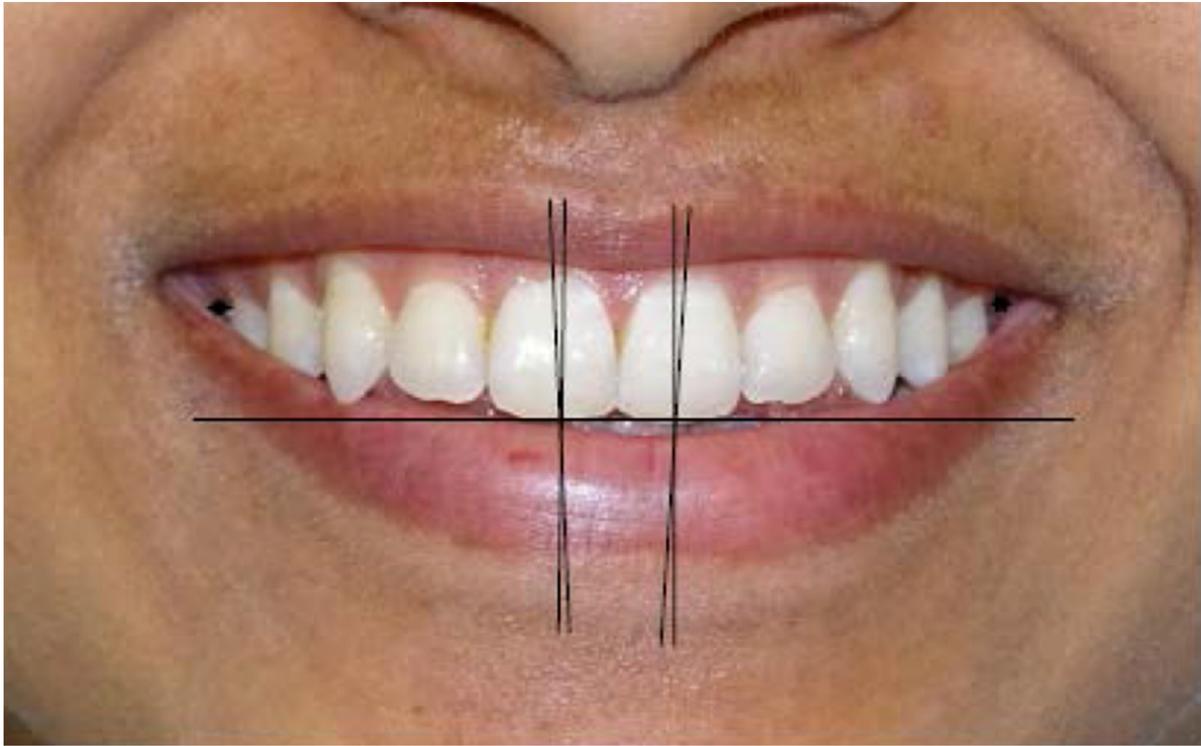


Figure 3. Measurement of incisor inclination in the posed photograph

sured on dental models, PA radiographs, and photographs were significantly higher in the non-aesthetic group than the aesthetic group ($P < 0.001$). Mean crown angulation for the aesthetic smile group was 3 - 7 degrees in dental casts, 2 - 6 degrees in PA X-rays and 2 - 5 degrees in photographic measurements.

5. Discussion

It is crucial for orthodontic specialists to be aware of the features of smile aesthetics, chiefly the role of the upper incisors, which is one of the most important aspects of a smile (7, 8). To explore the impact of orthodontic treatment on people's perception of smile aesthetics, four variables were applied in this study: (1) maxillary central incisor inclination, (2) maxillary central incisor angulation, (3) maxillary central incisor height and (4) width. Although various elements affect the smile, these variables are simple to perceive by laypersons. Previous studies have also been performed among other races to identify the average inclination and angulation of the incisors. Nevertheless, treating individuals only to reach cephalometric norms does not promise aesthetic results. Therefore, it was

important to study different ethnic backgrounds in order to determine whether or not race has an influence on the aesthetic preferences of maxillary incisor inclination.

In this study, we found that a slight proclination from the ideal norms is more aesthetic than retroclined maxillary incisors. Isiksal et al. who also compared the attractiveness of smiles of treated patients to patients who had not been treated orthodontically, revealed that in the group who had not undergone extraction, elevating the upper incisor to SN plane angle could result in a decrease in smile aesthetics (9). Following a similar trend, results of the current study revealed that proclination higher than a certain value is considered to be unaesthetic. Andrews suggested that for reaching the most aesthetic result, the labial aspect of the upper incisors should be along a vertical line perpendicular to Frankfort horizontal passing through glabella (9, 10). The results of this study indicated that slightly proclined incisors than the ideal may not be negatively considered by the general population in central India.

The current study showed that laypeople prefer slightly proclined teeth. Lateral cephalograms of the same sample show an average of $107^\circ \pm 2.08^\circ$ angle between

Table 3. Comparison of Central Incisor Angulation Measured on Dental Cast, PA Radiographs and Photographs Between Aesthetic and Unaesthetic Smile Groups

Parameters	Aesthetic Smile Group			Unaesthetic Smile Group			Mann-Whitney U Test (P Value)
	Mean \pm SD	Median	Min-Max	Mean \pm SD	Median	Min-Max	
Dental Model Incisor Angulation ($^{\circ}$)							
Right central incisor	4.72 \pm 1.10	5	3 - 7	9.24 \pm 2.15	9	6 - 15	< 0.001 ^a
Left central incisor	4.48 \pm 1.16	5	2 - 7	10.48 \pm 3.62	10	5 - 20	< 0.001 ^a
IOPA Incisor Angulation ($^{\circ}$)							
Right central incisor	4.32 \pm 1.22	4	2 - 6	8.80 \pm 3.86	9	4 - 20	< 0.001 ^a
Left central incisor	4.04 \pm 1.21	4	2 - 6	8.44 \pm 4.24	8	4 - 20	< 0.001 ^a
Photograph Incisor Angulation ($^{\circ}$)							
Right central incisor	3.16 \pm 0.69	3	2 - 4	7.84 \pm 2.53	8	3 - 12	< 0.001 ^a
Left central incisor	3.96 \pm 0.89	4	3 - 5	7.84 \pm 2.53	8	3 - 12	< 0.001 ^a

^a Significant at P < 0.001.

the long axis of incisors and the SN plane which is more than Rakosi's norm ($102^{\circ} \pm 2^{\circ}$) and $117.52^{\circ} \pm 14.53^{\circ}$ for non-aesthetic smiles. Additionally, the angle between the long axis of incisors and the palatal plane was $61.08^{\circ} \pm 6.61^{\circ}$ for aesthetic smiles, which indicates that a slight proclination of incisors is considered to be acceptable by laypersons (11).

A study conducted by Najafi et al. found that labial inclination is preferable compared to lingual inclination and in orthognathic mandibles, the image with the most retroclined incisors was chosen as least appealing. The results of the present study are in accordance with the results obtained by Najafi et al, showing that the labial inclination of central incisor is preferred in the female population (2).

Similar results were shown in a study conducted by Doodamani et al. in the south Indian population. He found that elevated maxillary positive crown inclination values for central and lateral incisors were noted (3). On the contrary, Cao et al. (12) have reported that maxillary incisor protrusion and lingual inclination were preferable compared with retruded or flared incisors. Naini et al. (13) reported that excessive proclination appeared to be less desirable than retroclination. They also believed that inclination of more than 105 degrees usually requires orthodontic treatment.

Another study by Ghaleb et al. (5) found that central incisor inclination to the SN and palatal plane is 107 degrees and 64 degrees, respectively, for an aesthetic smile. Schlosser et al. (7) suggested that it is desirable to keep a normally protrusive upper dentition or advance, than retract the upper anterior teeth. Results of the current study are similar to the reports of the above mentioned researches.

The second parameter of our study was the angulation of right and left maxillary central incisors. Our results showed the increased angulation of crown in the unaesthetic smile group. The results also depict that the angulation of maxillary central incisors in aesthetic smiles in central Indian female population is less than Andrew's norms. Similar results were shown in study conducted by Doodamani et al. (3). He found that the angulation for maxillary central incisor is 5 ± 0.5 degrees in south Indian population. Contrary results were reported by Thomas et al. (14) in Caucasian female subjects. They found that the mean acceptable threshold was 6.4 ± 4.0 degrees, and the axial angulation of 10 degrees or greater is generally unacceptable and should be assessed for orthodontic treatment.

The third parameter studied was the crown height and width of maxillary central incisors. Both the crown height and width remained well within the normal range mentioned in the standard text books (15). However, the height remained slightly higher in the unaesthetic smile group. Another study was conducted by Alsulaimani et al. (16) to realise if changes in the upper central and lateral incisors' length and width could influence the perception of smile attractiveness and to conclude the most desirable length and width for the incisors. They found that changes in the incisors' width and length influenced relative smile desirability for people, dentists and orthodontists. Results were quite interesting. Dentists and orthodontists did not welcome lateral width decrease of more than 0.5 mm. But laypeople did not accept lateral width reduction of more than 1 mm. All did not accept changes in central crown length. In lateral incisors, laypeople appeared more tolerant than dentists and orthodontists, which reveals that dif-

ferences in incisor proportions affect the smile attractiveness. One of the recent articles on the influence of tooth size variation on the overjet has shown that tapered and ovoid teeth tended to increase the overjet and overbite (17). This indirectly confirms the importance of normal height and width ratio of the central incisors on the smile aesthetics.

According to the results of this study, laypeople prefer slight proclined upper incisors. This data could be beneficial for dentists treating borderline cases that could possibly be treated without extractions. However, one has to take into consideration other crucial factors which affect the perception of smile aesthetics, such as buccal corridor area, gingival display, smile arc, lip line, etc. Previous studies have emphasised that increased gingival display, increased width of negative spaces, and maxillary midline shift are considered to be unattractive by laypeople (18-21).

It was difficult to use a proper technique to evaluate incisor crown inclination since the mostly used radiographic assessment contains major drawbacks. Considering the line between the incisor tip and the apex might not be reflective of the "true" inclination of incisors. Additionally, the radiographs normally record the most prominent incisor, and there might be a superimposition of teeth and the apices of the six anterior teeth might not be clear. One can also take advantage of the advanced diagnostic tools like CBCT to assess maxillary incisor crown inclination.

5.1. Conclusion

- Upper incisor inclination affects smile aesthetics in the posed smile photograph.

- Laypersons preferred slightly more proclined maxillary incisors than retroclined maxillary central incisors.

- Average angulation of 4° - 5° was more preferable for maxillary central incisors for an aesthetic smile.

- For an aesthetic smile, maxillary central incisor crown height of 9.50 mm and crown width of 8.00 mm was more acceptable.

Footnotes

Authors' Contribution: Study concept and design, TRS, RS; Acquisition of data, RS; Analysis and interpretation of data, TRS; Drafting of the manuscript, TRS; Critical revision of the manuscript for important intellectual content, AT, AG; Statistical analysis, TRS, AG; Administrative, technical, and material support, AT; Study supervision, TRS.

Conflict of Interests: None

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References

1. An SM, Choi SY, Chung YW, Jang TH, Kang KH. Comparing esthetic smile perceptions among laypersons with and without orthodontic treatment experience and dentists. *Korean J Orthod.* 2014;**44**(6):294-303. doi: [10.4041/kjod.2014.44.6.294](https://doi.org/10.4041/kjod.2014.44.6.294). [PubMed: [25473645](https://pubmed.ncbi.nlm.nih.gov/25473645/)]. [PubMed Central: [PMC4250663](https://pubmed.ncbi.nlm.nih.gov/PMC4250663/)].
2. Zarif Najafi H, Oshagh M, Khalili MH, Torkan S. Esthetic evaluation of incisor inclination in smiling profiles with respect to mandibular position. *Am J Orthod Dentofacial Orthop.* 2015;**148**(3):387-95. doi: [10.1016/j.ajodo.2015.05.016](https://doi.org/10.1016/j.ajodo.2015.05.016). [PubMed: [26321336](https://pubmed.ncbi.nlm.nih.gov/26321336/)].
3. Doodamani GM, Khala AS, Manohar M; Umashankar. Assessment of crown angulations, crown inclinations, and tooth size discrepancies in a South Indian population. *Contemp Clin Dent.* 2011;**2**(3):176-81. doi: [10.4103/0976-237X.86449](https://doi.org/10.4103/0976-237X.86449). [PubMed: [22090760](https://pubmed.ncbi.nlm.nih.gov/22090760/)]. [PubMed Central: [PMC3214523](https://pubmed.ncbi.nlm.nih.gov/PMC3214523/)].
4. Sharma PK, Sharma P. Dental smile esthetics: The assessment and creation of the ideal smile. *Semin Orthod.* 2012;**18**(3):193-201. doi: [10.1053/j.sodo.2012.04.004](https://doi.org/10.1053/j.sodo.2012.04.004).
5. Ghaleb N, Bouserhal J, Bassil-Nassif N. Aesthetic evaluation of profile incisor inclination. *Eur J Orthod.* 2011;**33**(3):228-35. doi: [10.1093/ejo/cjq059](https://doi.org/10.1093/ejo/cjq059). [PubMed: [20716642](https://pubmed.ncbi.nlm.nih.gov/20716642/)].
6. White SC, Pharoah MJ. Intraoral radiographic examinations. *Oral radiology: Principles and interpretation.* 5th ed. St. Louis, USA: Mosby; 2004. p. 121-65.
7. Schlosser JB, Preston CB, Lampasso J. The effects of computer-aided anteroposterior maxillary incisor movement on ratings of facial attractiveness. *Am J Orthod Dentofacial Orthop.* 2005;**127**(1):17-24. doi: [10.1016/j.ajodo.2003.11.025](https://doi.org/10.1016/j.ajodo.2003.11.025). [PubMed: [15643410](https://pubmed.ncbi.nlm.nih.gov/15643410/)].
8. Bass NM. Measurement of the profile angle and the aesthetic analysis of the facial profile. *J Orthod.* 2003;**30**(1):3-9. doi: [10.1093/ortho/30.1.3](https://doi.org/10.1093/ortho/30.1.3). [PubMed: [12644600](https://pubmed.ncbi.nlm.nih.gov/12644600/)].
9. Isiksal E, Hazar S, Akyalcin S. Smile esthetics: Perception and comparison of treated and untreated smiles. *Am J Orthod Dentofacial Orthop.* 2006;**129**(1):8-16. doi: [10.1016/j.ajodo.2005.07.004](https://doi.org/10.1016/j.ajodo.2005.07.004). [PubMed: [16443472](https://pubmed.ncbi.nlm.nih.gov/16443472/)].
10. Andrews WA. AP relationship of the maxillary central incisors to the forehead in adult white females. *Angle Orthod.* 2008;**78**(4):662-9. doi: [10.2319/0003-3219\(2008\)078\[0662:AROTMC\]2.0.CO;2](https://doi.org/10.2319/0003-3219(2008)078[0662:AROTMC]2.0.CO;2). [PubMed: [18302465](https://pubmed.ncbi.nlm.nih.gov/18302465/)].
11. Rakosi T. Dento-alveolar analysis. *An atlas and manual of cephalometric radiography.* California, USA: Lea & Febiger; 1982. p. 66-76.
12. Cao L, Zhang K, Bai D, Jing Y, Tian Y, Guo Y. Effect of maxillary incisor labiolingual inclination and anteroposterior position on smiling profile esthetics. *Angle Orthod.* 2011;**81**(1):121-9. doi: [10.2319/033110-181.1](https://doi.org/10.2319/033110-181.1). [PubMed: [20936964](https://pubmed.ncbi.nlm.nih.gov/20936964/)].
13. Naini FB, Manouchehri S, Al-Bitar ZB, Gill DS, Garagiola U, Wertheim D. The maxillary incisor labial face tangent: clinical evaluation of maxillary incisor inclination in profile smiling view and idealized aesthetics. *Maxillofac Plast Reconstr Surg.* 2019;**41**(1):31. doi: [10.1186/s40902-019-0214-4](https://doi.org/10.1186/s40902-019-0214-4). [PubMed: [31478034](https://pubmed.ncbi.nlm.nih.gov/31478034/)]. [PubMed Central: [PMC6701796](https://pubmed.ncbi.nlm.nih.gov/PMC6701796/)].
14. Thomas JL, Hayes C, Zawaideh S. The effect of axial midline angulation on dental esthetics. *Angle Orthod.* 2003;**73**(4):359-64. doi: [10.1043/0003-3219\(2003\)073<0359:TEOAMA>2.0.CO;2](https://doi.org/10.1043/0003-3219(2003)073<0359:TEOAMA>2.0.CO;2). [PubMed: [12940555](https://pubmed.ncbi.nlm.nih.gov/12940555/)].

15. Nelson SJ. The permanent maxillary incisors. *Wheeler's dental anatomy, physiology and occlusion*. 9th ed. St. Louis, USA: Elsevier Health Sciences; 2010. p. 99–106.
16. Alsulaimani FF, Batwa W. Incisors' proportions in smile esthetics. *J Orthod Sci*. 2013;**2**(3):109–12. doi: [10.4103/2278-0203.119685](https://doi.org/10.4103/2278-0203.119685). [PubMed: [24987650](https://pubmed.ncbi.nlm.nih.gov/24987650/)]. [PubMed Central: [PMC4072381](https://pubmed.ncbi.nlm.nih.gov/PMC4072381/)].
17. Kurita T, Mizuhashi F, Sato T, Koide K. Relationships between the upper central incisor crown forms and degree of labial inclination, overbite, and overjet in Japanese young adults. *J Adv Prosthodont*. 2020;**12**(6):338–43. doi: [10.4047/jap.2020.12.6.338](https://doi.org/10.4047/jap.2020.12.6.338). [PubMed: [33489017](https://pubmed.ncbi.nlm.nih.gov/33489017/)]. [PubMed Central: [PMC7790601](https://pubmed.ncbi.nlm.nih.gov/PMC7790601/)].
18. 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. doi: [10.1155/2016/7815274](https://doi.org/10.1155/2016/7815274). [PubMed: [27774105](https://pubmed.ncbi.nlm.nih.gov/27774105/)]. [PubMed Central: [PMC5059586](https://pubmed.ncbi.nlm.nih.gov/PMC5059586/)].
19. Sriphadungporn C, Chamnannidiadha N. Perception of smile esthetics by laypeople of different ages. *Prog Orthod*. 2017;**18**(1):8. doi: [10.1186/s40510-017-0162-4](https://doi.org/10.1186/s40510-017-0162-4). [PubMed: [28317085](https://pubmed.ncbi.nlm.nih.gov/28317085/)]. [PubMed Central: [PMC5357618](https://pubmed.ncbi.nlm.nih.gov/PMC5357618/)].
20. Aldeeri AA, Alhababi KA, Algahtani FA, Tounsi AA, Albadr KI. Perception of altered smile esthetics by orthodontists, dentists, and laypeople in Riyadh, Saudi Arabia. *Clin Cosmet Investig Dent*. 2020;**12**:563–70. doi: [10.2147/CCIDE.S272226](https://doi.org/10.2147/CCIDE.S272226). [PubMed: [33239919](https://pubmed.ncbi.nlm.nih.gov/33239919/)]. [PubMed Central: [PMC7682443](https://pubmed.ncbi.nlm.nih.gov/PMC7682443/)].
21. Almana R, Modimigh A, Almogren F, Alhazzani E. Perception of smile attractiveness among orthodontists, restorative dentists, and laypersons in Saudi Arabia. *J Conserv Dent*. 2019;**22**(1):69–75. doi: [10.4103/JCD.JCD_429_18](https://doi.org/10.4103/JCD.JCD_429_18). [PubMed: [30820086](https://pubmed.ncbi.nlm.nih.gov/30820086/)]. [PubMed Central: [PMC6385572](https://pubmed.ncbi.nlm.nih.gov/PMC6385572/)].