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The Influence of Vertical Canine Position on Smile Esthetics: A Comparative Perception Based Study Among Orthodontists and Laypersons

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ABSTRACT

Objective: The research investigates the unique effect of altering vertical canine positions on smile esthetics, focusing on a comparative analysis of perceptions between orthodontic professionals and laypersons.

Materials and Methods: This cross-sectional comparative study was conducted in Armed Forces Institute of Dentistry, Rawalpindi from September 2020 till August 2023. Hundred respondents were chosen to evaluate five smile photographs. Each photo, derived from a standard close-up, digitally modified to adjust the vertical position of canine tooth in 0.5mm increments. Respondents were tasked with rating the attractiveness of each image on a visual analog scale, ranging from one to five.

Results: Orthodontist rated image A at 2 out of 5 (42%) and rating of 4 out of 5 by laypeople (36%) (P<0.000). Image B was rated 4 out of 5 by both orthodontist (48%) and laypeople (34%) (P=0.002). Image C received the highest score of 5 out of 5 from both orthodontist (66%) and laypeople (42%) (P=0.031). Image D garnered rating of 2 out of 5 from orthodontist (48%) and 3 out of 5 from laypeople (32%) (P<0.001). Image E rated 1 by 37 orthodontists and 15 laypersons. Most orthodontist (74%) rated image E as 1 and layperson 2 (32%) out of 5 respectively (P<0.001).

Conclusion: Orthodontists exhibited higher sensitivity in evaluating smile esthetics compared to laypersons. The 0.5mm vertical intrusion of canine was perceived to be most attractive.

Keywords: Attractiveness, Buccal Corridors, Gingiva, Intrusion, Incisal Show

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INTRODUCTION

The word esthetics is derived from a Greek word "aisthesis" which means "to perceive".[1] One of the fundamental aims of orthodontic treatment is to create an aesthetically pleasing smile. However, beauty is a concept with both subjective and objective aspects. Consequently, perception of smile esthetics depends on multiple factors like cultural awareness, age and gender of the observer. In this context, observer's knowledge and experience are one of the most significant factors.[2] It is widely acknowledged that the more experienced and knowledgeable the clinician is, the more he or she is sensitive to perception of the minor esthetic details in smile of the patient.

Social smile is the one which an individual usually presents to the world, while meeting a colleague or posing for the camera. Social smile is reproducible and thus is the focus of orthodontic diagnosis and treatment planning.[3]

A symmetrical dental arrangement is considered to be of utmost importance in smile esthetics.[4] Harmony and balance in smile is achieved by paying attention to the intricate details.[5] Canines have a substantial effect on smile esthetics and occlusal functionality. Wheeler has described canines as "a foundation that insures normal facial expression." Vertical position of canines also has a marked effect on smile esthetics perception. The vertical position of tooth is categorized into two main features. Those related to incisor display and those related to gingival display. Sharma et al. found that the most attractive smiles were those exhibiting 1mm gingival recessions bilaterally on canines. Similarly, Acar et al. observed a considerable effect of canine vertical positionsmile aesthetics, with orthodontists and laypersons attributing 28.53% and 24.33% influence, respectively with a P value <0.0001). A similar study related to the vertical position of maxillary canines with respect to smile line conducted by Bin Muharib et al[9] states that gingival margins of canines should be coincident with the upper lips on smile.

The study conducted by Patankar et al[10] concluded that orthodontists were more critical in analyzing asymmetries in gingival margins of maxillary canines than laypersons and general dentists (P<0.05). These studies indicate a difference of perception among different populations.

The objective of this study is to determine and compare the influence of altered vertical position of canines on smile esthetics as a mean perception by an orthodontist and a layperson.

MATERIALS AND METHODS

This survey based cross-sectional study was conducted in Orthodontics Department of Orthodontics in Armed Forces Institute of Dentistry (AFID), Pakistan, after taking approval from the ethical committee (Ltr no: 918/Trg Dated 13 May 2020), from September 2020 till August 2023, encompassing a sample of one hundred participants were selected for this study, consisted of fifty orthodontists and fifty laypeople. The sample size was calculated by utilizing World Health Organization (WHO) sample size calculator 7.1, with confidence level of 95%. Perception of standard smile by orthodontist was equal to 80.24 ± 5.4[11] Precision of 1% was required for this study. The sampling technique was nonprobability consecutive. This study's inclusion criteria included both male and female orthodontist and laypeople aged 18 to 40. The orthodontists related to this study were either who recently completed their training or currently undergoing training. Laypeople selected for this study were those who had no history of orthodontic treatment in the past. Exclusion criteria was any patient with history of body dysmorphic disorders, with any kind of known psychological disorders and respondents with any sort of eye disorder or defect in visual acuity. The data was collected from the shortlisted participants. Participants who consented to undergo the study agreed that they had been fully informed about the objectives of the study and the study causes no harm to any living or nonliving thing in any manner of speaking. A pre-validated questionnaire was selected.[12] Online application known as Google Forms was utilized to formulate the questionnaire. Questionnaire consisted of a total number of ten questions. The questionnaires were distributed among fifty orthodontists and fifty laypeople. Five images of a smile were attached in the questionnaire. One image of smile was taken as standard using a digital camera (Canon EOS-REBEL). The photograph was digitally manipulated using Adobe Photoshop CC 2018 software so that only desired area of face would be framed while in the other four images, the vertical position of canine was altered by digital manipulation of the photograph. The images presented in the questionnaires showed the level of vertical position of canines being changed at an increment of 0.5mm per

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picture (Figure 1). One picture was taken as a standard picture which has normal vertical position of maxillary canines coinciding with the occlusal plane whereas the other images had intruded and extruded canines. The participants were asked to rate the images using a visual analog scale.[13,14] The visual analog scale used for rating the images consisted of scores ranging from one to five. The score of one represented the least attractive smile. The score of five represented the most attractive smile. The scores given by the participants were noted down on a separate sheet of paper by the researcher along with the participants name, age, gender and occupation. The data was analyzed by using SPSS version 24.0. Mean and standard deviation were calculated for quantitative variables like vertical position of canines and age (Perception by orthodontists and laypersons). Frequency and percentage were calculated for qualitative variables like gender and occupation. The chi square test was used to test the difference between smile esthetic perception between orthodontist and layperson. The independent sample t test was used to test the difference of mean perception score between two groups P-value ≤ 0.05 will be taken as significant.

RESULTS

The mean age of both respondents was 30.47±4.82, minimum and maximum age in years was 18 and 40 years respectively. Similarly average vertical canine position was 2.35±0.64, minimum 1.19 and maximum was 3.47. Out of 100 responders, maximum 69% were female and 31% were male.

Majority of the responders were very clear (97%) how to rate image A to E in this study whereas just 3 (3%) were slightly confused and not clear about the objective of the study and was trained while data collection to control the bias. The bar diagram of response against images A to E reflects in the figure 2. The comparison of perception score against A to E between orthodontist and laypersons is shown in (Table 1).

Figure 1: Altered Images with 0.5mm Increments Showing Change in Vertical Canine Position

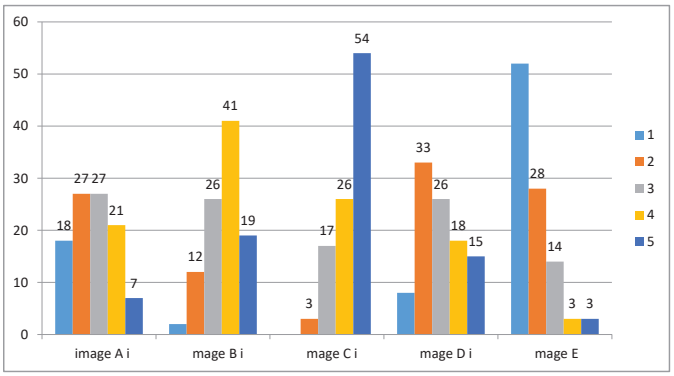

Figure 2: Bar Diagram of Smile Esthetic Perception Against Images A-E

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Table 1: Cross tabulation of smile esthetic perception on images A to E with respect of respondent

Smile esthetic perception grades	Respondent		P value
	Orthodontist	Layperson	
Image A			
1	15	3	0.000
2	21	6	
3	11	16	
4	3	18	
5	0	17	
Image B			
1	2	0	0.002
2	9	3	
3	12	14	
4	24	17	
5	3	16	
Image C			0.031
1	1	2	
2	9	8	
3	7	19	
4	33	21	
5			
Image D			
1	7	1	0.000
2	24	9	
3	10	16	
4	4	14	
5	5	10	
Image E			
1	37	15	0.000
2	11	17	
3	1	13	
4	1	2	
5	0	3	

The independent sample t test was used to test the difference of mean perception score between two groups against image A to E. The results showed that the mean perception score of orthodontists (4.68 ± 0.62) was significantly greater than the average perception score of laypersons (3.76 ± 1.24) with p value 0.000.

The results were same after stratification with responder's gender and age groups. As the average smile esthetic perception score was greater than layperson with p value 0.000 in female and the results was same with p value 0.014 in male responders only (Table 2). Similarly, the results were same in both age groups and the orthodontist's smile perception score was greater than laypersons in less or equal to 30 years of age with p value 0.000 and in more than 30 years of age with p value 0.016. (Table 3)

Table 2: Comparison of Perception Score against Image A to E between Orthodontist and Layperson with Stratification of Responder's Gender

Gender	Respondent	Mean ± Standard deviation	P value
Female	Orthodontist	4.65 ± 0.68	0.000
	Layperson	3.75 ± 1.11	
Male	Orthodontist	4.77 ± 0.44	0.014
	Layperson	3.78 ± 1.45	

Table 3: Comparison of Perception Score against Image A to E between Orthodontist and Layperson with Stratification of Responder's Age

Age	Respondent	Mean ± Standard deviation	P value
Less or equal to 30 years	Orthodontist	4.73 ± 0.59	0.000
	Layperson	3.73 ± 1.14	
More than 30 years	Orthodontist	4.66 ± 0.64	0.016
	Layperson	3.80 ± 1.40	

DISCUSSION

Well positioned canine teeth are not only an important factor for good smile esthetics but they also determine the occlusion functionality of the dentition.[15,16] Establishment of canine guidance is important for achieving a harmonious occlusion and balanced masticatory system. Canine teeth are known as the corner stones of the mouth because they are located lateral to the midline and separate incisors from the premolars.

Studies done by some authors concluded that perception of smile esthetics is not influenced by facial features such as eyes, shape of the face and nose.[8,17] Whereas some authors suggested to utilize a close up of smiling photograph rather than a full face shot while assessment of difference of perceptions of smile esthetics because in their opinion, judgment of smile is made better when the observer is only observing the dental characteristics of the smile rather than the other facial features which

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might be a distraction to the observer while perceiving the esthetics of the smile. In our study, we only utilized a smiling photograph rather than a full-face photograph and we modified a single smiling photograph and made five images from it consisting of variable vertical position of canine teeth in each image.

In our study we asked the observers to rate the five images and we displayed these images in a form of questionnaire with visual analog scale ranging from score one to five. To eliminate bias, the scores were recorded by only one evaluator who recorded the scores given by the observers on a separate sheet along with the observers name, age, gender and profession.

The results of study by John Katsis et al[18] showed that there was not much difference in the smile esthetic perceptions of orthodontically treated fifteen years old based on the three-dimensional position of maxillary canine teeth as judged by nine residents of orthodontics department. In contrast to their study, our study showed that the difference in vertical position of the canine teeth affected the smile esthetic perception for both orthodontists and laypeople. Orthodontists were slightly more perceptive of the effect of changes in vertical position of canine teeth on smile esthetic perception.

The results of this study was very similar to study by Paiva et al[19] who also used smiling photograph of a male patient and altered the vertical positions and the gingival margins of the canines utilizing one standard close up smiling image and alterations were made and ten photographs were produced, by an increment of 0.5mm varying from 1mm intrusion to 1mm of extrusion. Furthermore, they took a sample size of one hundred and twenty participants who rated the photographs where as in our study we took a sample size of one hundred participants who rated the smiling photographs. Similar to our study their study utilized a visual analog scale for scoring each image, however their score ranged from one to ten, one being the least attractive and ten being the most attractive whereas our score on visual analog scale ranged from one to five, one being the least attractive and ten being the most attractive.

This study, we selected fifty orthodontist and fifty laypeople according to the inclusion and exclusion criteria set for our study. We fully informed the participants about the objectives of our study in order to avoid any confusion among the participants, furthermore we allowed our participants to ask questions if they had any kind of doubts in their minds regarding our study. Three percent of the participants expressed confusion regarding the objectives of our study, these participants were educated further about the objective of our study as in how it will help to bridge the gap between orthodontist and laypeople's opinion while formulating the treatment plan. These participants were fully trained before beginning the data collection procedure in order to ensure that there was no biasedness in our study.

In contrast to the study by Paiva et al[19], we provided our participants with questionnaires comprising of ten questions generated with the help of Google Forms.[12] The questionnaire comprised of ten questions in which there were close up images of smile showing different vertical position of canine teeth and the raters were asked to rate each photograph on a visual analog scale ranging from one to five.

Among the five close-up smile photographs we used in our questionnaire for the responders to rate on visual analog scale, image C was the most ideal image because it represented the ideal vertical position of canine in the smile and it represented the vertical position of canine tooth which every orthodontist strives to achieve. According to the results of our study, the respondents gave the highest score to image C which shows that it represents the most esthetically pleasing smile with the most esthetic vertical position of canine.

A study conducted by Lemos et al[20] on the impact of variations in torque of the maxillary canines on the esthetic perceptions of smile among orthodontists and laypeople. Their study differed from our study as they compared the torque variations of the maxillary canine as compared to the vertical position of the canine teeth compared in our study.[21–23] Their study also compared the smile esthetic perceptions among orthodontists and laypeople similar to our study; however their sample size slightly varied from our sample size. They used both female and male models and used their smiling photographs in their study, where as in our study, we only utilized smiling photographs of one female model. They used both full face and close up smiling photographs for their study where as we only utilized close up smiling photographs with gingival

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show for our study. Similar to our study, they asked the orthodontists and laypeople to rate the photographs based on the attractiveness of each photograph utilizing a visual analog scale.[24,25] Their results showed that orthodontists and laypeople slightly differed in assessing the effect of torque incorporation on smile esthetics.[21,22]

There were few limitations in our study. Firstly, in our study, we did not take our sample which was proportionate in gender distribution. The orthodontists as well as well as the laypeople were selected randomly, and no predetermined number of gender criteria was set for the selection. Over all in our study, there were thirty one percent respondents who were male (thirty-one males) and sixty nine percent respondents who were females (sixty-nine females). Thus, in our study, our sample mostly consisted of females. This disproportionate ratio of gender can incorporate gender bias in the study. The esthetic perception of both females and males can vary, thus gender bias can influence the results of our study. For better results, studies with equal distribution of gender among respondents and no gender biases are required.

Secondly, although we stated the objective of our study in clear laymen terminology so that it was comprehensible for both orthodontists and laypeople. The purpose of stating our objective was to remove any doubts about the study from the minds of both orthodontists and laypeople, so that they knew how their scores given for each image can influence the orthodontic treatment and can help enhance the understanding of orthodontists about what their patients desire in their smiles when they come to orthodontic department for treatment. Although we made sure that our objectives will be clear to both groups, three percent of the respondents (three out of hundred respondents) were not clear about the objectives. We aimed that all the respondents will be clear on the objectives of the study, however we realized we needed to be more elaborate. We tried to nullify this error on our part by training the three percent of respondents who were not clear about the objective and we made them ask any question they had in their minds.

CONCLUSION

There was difference in the scores given by orthodontist and layperson. The main reason is as miniesthetics analysis is integral part of orthodontic diagnosis and orthodontists were trained to analyze components of smile thoroughly and were more perceptive as compared to laypeople.

DISCLAIMER

None to declare.

CONFLICT OF INTEREST

There is no conflict of interest among the authors.

ETHICAL STATEMENT

Ethical approval was taken from Ethical Committee of Armed Forces of Dentistry Rawalpindi (Ltr no: 918/Trg Dated 13 May 2020)

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AUTHORS CONTRIBUTION

Conception and design of the study: N. Adnan, E. Amin
Acquisition of data: E. Amin
Analysis and interpretation of data: N. Adnan, E. Amin, Z. Nisar, N. Arshad
Drafting of the manuscript: N. Adnan, E. Amin, N. Arshad
Critical review of the manuscript: N. Adnan, E. Amin, Z. Nisar, N. Arshad
Approval of the final version of the manuscript to be published: N. Adnan, E. Amin, Z. Nisar, N. Arshad

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