

Contribution of Different Facial Components in Facial Attractiveness Assessed by Layperson, Dentists and Orthodontists

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ABSTRACT:

Introduction: This study aims to compare the differences in appraising contribution of different facial components to facial attractiveness in male and female participants by laypersons, dentists, and orthodontists. **Methods:** The Contribution of different facial components to facial attractiveness in participants is evaluated by 50 orthodontists, dentists, and laypeople on a 0 to 100 mm Visual Analogue scale.

Results: For female participants when assessed by orthodontists a significant correlation was found between facial attractiveness and smile($r=0.908$), chin($r=0.759$), nose($r=0.672$) and skin($r=0.630$). When evaluated by dentists a significant correlation was found between facial attractiveness- smile($r=0.634$), skin($r=0.773$) and hairs($r=0.661$). When rated by layman, there was a significant correlation between facial attractiveness- smile($r=0.986$) and skin($r=0.758$). For male participants when assessed by orthodontists a significant correlation was found between facial attractiveness and smile($r=0.827$), chin($r=0.764$) and skin($r=0.648$). Facial attractiveness and smile ($r = 0.964$), and skin ($r = 0.911$) had significant correlations when rated by layman. While for dentists facial attractiveness and smile($r=0.611$), skin ($r=0.612$) and eyes($r=0.673$) shows significant correlation.

Conclusions: For female participants, according to orthodontists the contributing variables were smile, chin and nose, according to dentists smile, skin and hairs and according to layman smile and skin are the predictor variable. For male participants according to orthodontists, the contributing variables are smile, chin and skin and according to dentists smile, skin and eyes while according to layman skin and smile are the contributing variables.

Practical implications: This study aids dentists and orthodontists in understanding what additional corrections are required for enhancing facial aesthetics after tooth alignment since other facial features also greatly influence facial attractiveness.

Keywords-Facial attractiveness, Orthodontists, Dentists, Layman.

INTRODUCTION

As the face has a key contribution to physical attractiveness, facial attractiveness is the most important factor in determining the external appearance and physical attractiveness of an individual.^{1,2} A beautiful face can influence the character evaluation, partner selection, and employment prospects, making the attractive more likely to succeed in a variety of undertakings.^{3,4} A beautiful face can make you look younger, healthier, more attractive, and successful. Discrimination against those who have unattractive looks is rather widespread.⁵

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How to cite this article: Yadav E, Kumar M, Goyal M, Abrar MD, Garg C, Sangal S. Contribution of Different Facial Components in Facial Attractiveness Assessed by Layperson, Dentists and Orthodontists. TMU J Dent 2024; 11(1): 1-9.

Submitted: 15 Dec 2023 Revised and accepted: 17 Dec 2023

Doi: <https://doi.org/10.58358/tmujd.ort11101o>

Patients sometimes wonder if they will look more beautiful following orthodontic treatment and have worries regarding the long-term cosmetic effects. However, these are difficult issues to answer because teeth are only one component of the face, and no single feature in the face is responsible for overall attractiveness. The face is made up of several parts, including the eyes, nose, lips, teeth, and chin, each of which contributes to facial attractiveness.

In humans, facial attractiveness has been widely studied by philosophers, psychologists, medical scientists, computer scientists, and biologists.⁶⁻⁸ Cunningham et al conclude that in males attractiveness is linked with prominent cheekbones, square jaw, or a large chin while female beauty is associated with youthful facial characteristics such as large and wide eyes, a larger inter-eye distance, a wide smile and a tiny chin.^{9,10} According to previous studies, the facial skin appearance also affected the attractiveness perception of humans.¹¹ As a result, the total attractiveness of the face cannot be entirely determined by teeth, nor can it be assumed that once the teeth are aligned, the entire face will become more appealing. Therefore, when soft tissues and teeth are treated, knowing the relationship between each feature and the overall beauty of the face can help define the limitations of orthodontics.

Depending on personal and social experiences of different peoples have different views regarding facial aesthetics. Aesthetic standards for lay people were formed by actresses and models featured in the entertainment media, but dentists' perceptions will be based more on dental

aesthetics. Differences also arise while rating the attractiveness of opposite sex such as women placing a lower value on appearance than men.

As a result, the primary goal of this study is to compare the differences in appraising the contribution of different facial components to facial attractiveness in male and female participants by laypersons, dentists, and orthodontists.

MATERIAL & METHODS

The sample size¹² was calculated using formula $n = (Z_c \sigma/E)^2$ where Z_c = critical value of the Normal distribution at $\alpha/2$, σ is standard deviation and E is the effect size, which shows a sample size of 50 is needed in each group of the rater. For this study material, 23 females and 25 males of Indian origin were screened, with a mean age of 22.5 years for males and 21.8 years for females, and 20 persons (10 males and 10 females) were chosen who met the study's inclusion criteria.

The inclusion criteria for participants (male and female) in this study were no history of orthodontic treatment and normal shape and size of maxillary anterior teeth (neither too big nor too small, conical, fused, geminated, or curved), while the exclusion criteria were craniofacial deformities, significant periodontal disease, or gingivitis fillings, and cavities in the maxillary anterior teeth. The inclusion criteria for raters such as Orthodontists and dentists were at least 10 years of expertise, while for lay people no prior dental treatment history. Equal numbers of males and females were taken in each group of raters.

Following permission by the university ethical committee (xxxxxx/xxx/xx-xx/xxxx), data was collected during a one-month period. The participants gave their informed permission. Frontal photographs of patients were taken in a natural head position, looking straight ahead with a posed smile on a neutral background. While taking photographs individuals face was free of makeup, jewelry and glasses. A Nikon D5600 DSLR camera with a 105 mm macro lens was used for photography. The camera was placed on a tripod stand 1.5 metres away from the patient's head, with the camera's height matching that of the patient's head.

Using Adobe Photoshop programme CS2, version 9.0, numerous facial components were extracted from the original photograph of the smiling face, including the smile, nose, eyes, chin, hair, eyebrows, and skin, similarly for male and female participants. All the photos have been converted into black and white except for the skin to remove the error due to skin colour variation. The photographs were taken with 10*10 mm reference sticker¹³ placed in the forehead region of individuals maintaining their relative size and proportion. The 50 orthodontists, 50 dentists, and 50 lay people then evaluated all of the photographs in a PowerPoint presentation. The slides were presented in the same order to each rater.

A Visual Analogue Scale (VAS) with a 0 to 100 mm continuous line is used for image assessment with unattractive at 0mm and attractive at 100 mm (Figure 1). Each rater was given a 16-page booklet, 8 pages for rating female participants and 8 pages for rating male participants, containing ten

Visual Analogue Scales on each page, with no time constraint to fill it. The raters were required to mark the vertical line along the scale with their assessment of each facial component. The measurement of the visual analogue scale is done by using a vernier caliper by the same person. A few randomly selected readings were measured again after a 2-week interval to check for intra-rater reliability. All of the results were rounded to the closest millimeter. 200 images (20 full-faced, 140 different facial element images and 40 repeated images) were divided in 3 PowerPoint presentations with no time restrictions to fill out¹⁴ (Figure 2). The sample of PowerPoint presentation slides for female participants was presented as eyes, smile, nose, eyebrows, chin, hair, skin, and full face (figure 3). There were no dropouts among the evaluators.

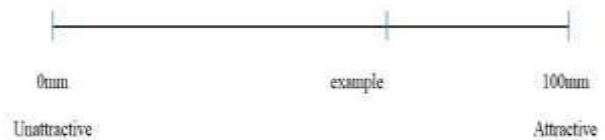


Figure 1. A Visual Analogue Scale used to evaluate the attractiveness of different facial components.

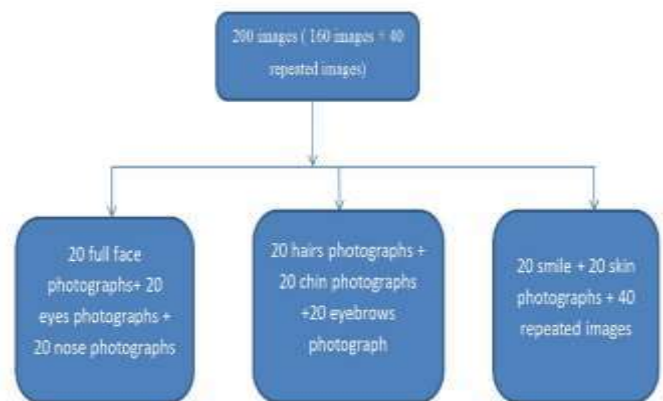


Figure 2. Distribution of the variables in slide show presentations

STATISTICAL ANALYSIS

The data collected was entered into a Microsoft Excel spreadsheet. Statistical Packages of Social Sciences (SPSS) 21.0 version software (IBM, Armonk, NY, USA) was used for processing and analyzing the data. Descriptive statistics including mean and standard deviation were calculated. All the assumptions of stepwise regression were assessed and followed. The Shapiro Wilk test was used for assessing the normality of data, which was found to be normally distributed. A Pearson correlation followed by forward Stepwise regression was used to

compare the differences in perception between laypersons, dentists and orthodontists in assessing the contribution of different facial components on facial attractiveness in male and female participants. All statistical tests were performed at 95% Confidence Interval (Significance level $P < 0.05$). The intra rater reliability for visual analogue scale measurement of few randomly selected variables (12% of the total visual analogue scale measurement) was measured after 2 weeks for the evaluation of Intraclass Correlation Coefficient.

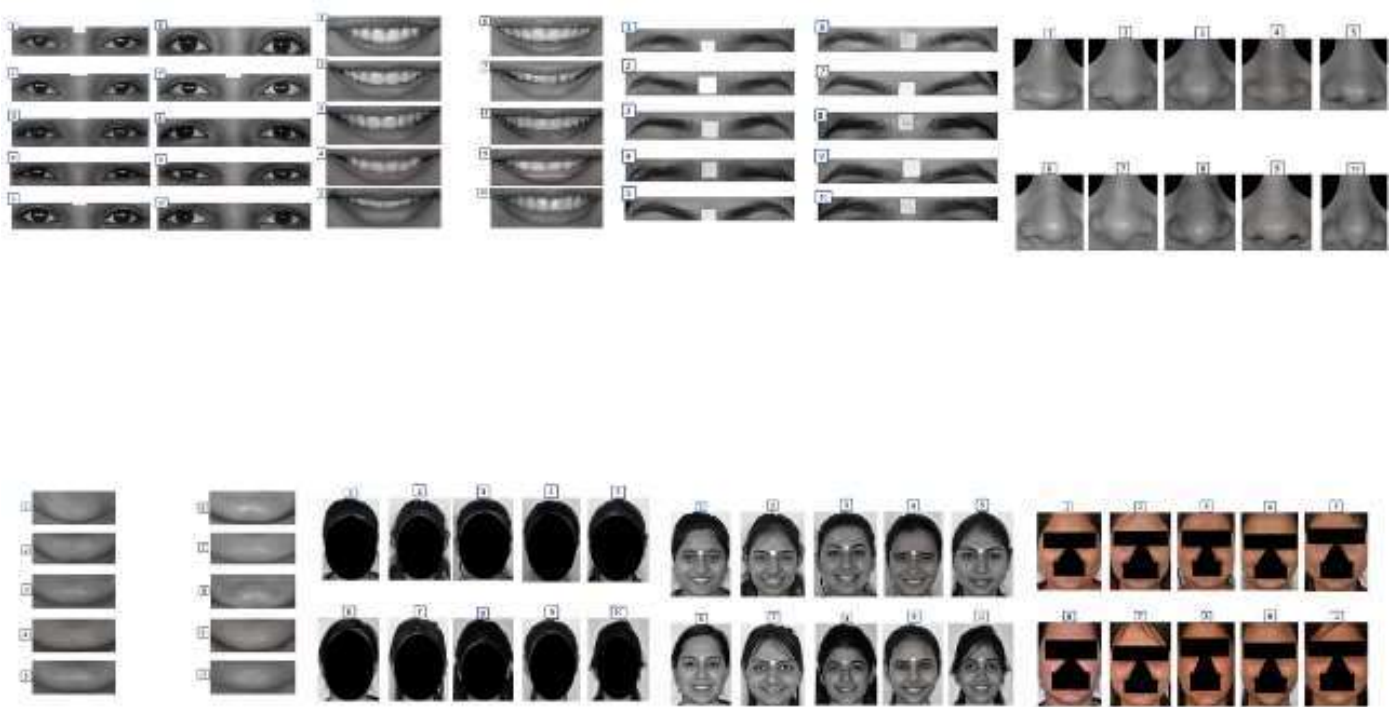


Figure 3. Eyes, Smile, Eyebrows, Nose, Chin, Hairs, Skin, Full face

RESULTS

The Intraclass Correlation Coefficient (ICC) showed high reliability with value of 0.91. Descriptive statistics (mean and standard deviation), for the female participants, is shown in Table 1 and for male participants in Table 2. The results of the Pearson correlation between the full face attractiveness and the various components of face for female and male participants according to orthodontists, dentists and layman is shown in Table 3.

VARIABLES	Orthodontists (n=50)		Dentists (n=50)		Layman (n=50)	
	Mean	SD	Mean	SD	Mean	SD
Smile	48.49	14.45	46.76	7.89	53.54	17.22
Chin	47.13	9.69	48.08	2.76	26.08	5.99
Skin	56.03	6.71	54.29	2.90	41.70	19.52
Eyes	46.91	5.24	47.22	6.05	39.49	15.44
Hairs	53.97	7.47	58.22	5.32	56.60	6.33
Eye brow	46.64	13.19	48.38	9.82	43.73	16.35
Face	48.41	16.64	52.89	7.45	49.32	20.92
Nose	46.59	8.87	52.09	3.60	47.39	10.31

Table 1. Descriptive statistics for attractiveness scores of the smile, chin, skin, eyes, hairs, eye brow, face and nose for females.

VARIABLES	Orthodontists (n=50)		Dentists (n=50)		Layman (n=50)	
	Mean	SD	Mean	SD	Mean	SD
Smile	37.95	5.14	39.79	3.68	39.26	7.93
Chin	38.28	6.64	46.15	3.16	21.80	7.31
Skin	50.79	3.34	50.43	2.54	22.12	10.15
Eyes	44.14	2.58	42.22	4.19	30.15	13.33

Hairs	57.90	4.07	58.77	6.18	53.16	6.21
Eye brow	33.92	5.12	39.06	4.77	32.54	7.45
Face	42.29	8.52	45.69	5.54	45.59	8.94
Nose	46.28	4.34	51.08	2.97	43.72	3.49

Table 2. Descriptive statistics for attractiveness scores of the smile, chin, skin, eyes, hairs, eyebrow, face and nose for males.

Variable	Pearson correlation coefficient (r)					
	Orthodontists (n=50)		Dentists (n=50)		Layman (n=50)	
	Female	Male	Female	Male	Female	Male
Smile	0.908**	0.827*	0.634*	0.611*	0.986**	0.964*
Chin	0.759*	0.764*	0.551	0.518	0.351	0.341
Skin	0.630*	0.648*	0.773*	0.612*	0.758*	0.911*
Eyes	0.353	0.260	0.422	0.673*	0.538	0.373
Hairs	0.46	0.465	0.661*	0.411	0.163	0.504
Eye brow	0.316	0.224	0.541	0.371	0.397	0.303
Nose	0.672*	0.402	0.242	0.16	0.349	0.242

Table 3. Pearson correlation results between facial attractiveness and other facial components for male and female participants according to Orthodontists, Dentists and Layman.

FEMALE PARTICIPANTS

When assessed by orthodontists, a significant correlation was found between facial attractiveness and smile ($r = 0.908$), facial attractiveness and chin ($r = 0.759$), facial attractiveness and nose ($r=0.672$) and facial attractiveness and skin ($r=0.630$). Facial attractiveness and smile ($r = 0.634$), facial attractiveness and skin ($r=0.773$) and facial attractiveness and hairs ($r=0.661$) were shown to have a significant correlation when evaluated by dentists. When rated by layman, there was a significant correlation between facial

attractiveness and smile ($r=0.986$) and facial attractiveness and skin ($r=0.758$).

In stepwise regression (Table 4) according to orthodontists, the predictive variables were smile, chin and nose which accounts for 99% variance in facial attractiveness. According to layman smile and skin are the predictors which accounts for 98% variance, and according to dentists smile, skin and hairs contributes for 83% variance in the face.

	VARIABLE	R	R Square	Adjusted R Square	P value
Orthodontists	Smile, Chin, Nose	0.994	0.989	0.983	0.001
Dentists	Smile, Skin, Hairs	0.832	0.799	0.724	0.020
Layman	Smile, Skin	0.986	0.973	0.969	0.001

Table 4. Results of Stepwise regression for female participants.

MALE PARTICIPANTS

When assessed by orthodontists, a significant correlation was found between facial attractiveness and smile ($r = 0.827$), facial attractiveness and chin ($r=0.764$), and facial attractiveness and skin ($r=0.648$). Facial attractiveness and smile ($r = 0.964$), and facial attractiveness and skin ($r = 0.911$) had significant correlations as rated by a layman. While for dentists facial attractiveness and smile ($r=0.611$), facial attractiveness and skin ($r=0.612$) and facial attractiveness and eyes ($r=0.673$) shows significant correlation.

In stepwise regression (Table 5) according to orthodontists, the predictive variables were smile, chin and skin which accounts for 94% variance in facial attractiveness. According to layman skin and smile are the predictor variables which account for 98% variability in the evaluation of facial attractiveness in males. While for dentists smile, skin and eyes were the

predictor variables which accounts for 81 % variance in facial attractiveness.

	VARIABLE	R	R Square	Adjusted R Square	P value
Orthodontists	Smile, Chin, Skin	0.947	0.964	0.945	0.001
Dentists	Smile, Skin, Eyes	0.811	0.799	0.724	0.030
Layman	Skin, Smile	0.982	0.964	0.953	0.001

Table 5. Results of Stepwise regression for male participants.

DISCUSSION

A study of the relationship between facial attractiveness and facial components, as well as the factors that influence it, will aid in communicating with patients and predicting the effect of correction, but few studies have looked at the importance of each face feature in overall facial attractiveness, so this study was designed with that goal in mind.

A smile plays an important role in facial expression and forms its essential part.^{15,16} A beautiful smile is determined by factors such as tooth size, shape, color, and location, as well as visible gingivae and all of these elements must work together to create a symmetrical and harmonic entity. A strong overall link is found between facial attractiveness and smile in this study, which may be due to the fact that in social interactions, attention is focused on the mouth, and thus on the grin. This result supports the conclusion of previous study,¹⁷ that the reason for patients frequently seeking dental care is their concerned about smile's appearance. The findings in our study are consistent with those of Joana Godinho¹⁴ in which smile contributes most to the facial attractiveness. Havens et al¹⁸ evaluated the importance of the posed smile in overall facial

aesthetics as assessed by lay people and orthodontists, and came to the conclusion that a smile is extremely essential for facial aesthetics, and that an unpleasant smile can have a detrimental influence on overall facial aesthetics while in a study by Tatarunaite et al¹⁹ they concluded that Orthodontic therapy enhances the appearance of a person's teeth, but it does not always make them more attractive in the long run.

The use of different methods for evaluating the facial components may explain the disparities in results between studies.

When assessed by orthodontists, chin also contributes in facial attractiveness. Previously several studies demonstrated the significance of the chin responsible for variations in facial attractiveness and they concluded that a tiny or narrow chin is linked to a more feminine appearance^{9,20} while in males broad chins are considered more attractive and masculine which leads to greater success in society than males with narrow chin.^{10,21} As a result, lower facial contouring become a popular cosmetic procedure in East Asia and various surgical procedures have been used to improve the appearance of the lower face.^{22,23}

According to Orthodontists, Layman and Dentists, skin also has a significant correlation with facial attractiveness. Previous research has demonstrated that the texture and colour of one's skin can impact one's perception of beauty and healthiness. For males Jones et al²⁴ concluded that facial skin health is favourably connected with facial attractiveness assessments and for females Fink et al²⁴ concluded that the distribution of facial skin colour determines the sense of age and beauty, irrespective of facial form and skin surface topography. Apart from smile, chin and skin, in this study eyes, nose and hairs were also found

as contributing factors for facial attractiveness which corroborates with the results of previous studies.^{10,20,25}

As we can appreciate in this study that predictor variables for male and female participants are different whether assessed by orthodontists, dentists or a layman. This difference can be explained by sexual dimorphism which plays an important role in attractiveness.²⁶⁻²⁸

A Visual Analogue Scale with a 0 to 100 mm continuous line is used in this study for image assessment as it is a simple, practical, and dependable measuring tool and has been used in previous studies also.^{12,14,26,27,29} In this study different facial component was shown separately instead of full face to the evaluators because in full face photographs it is difficult to concentrate on single facial element and leads to a weaker correlation between the variables. In addition, all similar elements, for example eyes of 10 female participants were arranged on the same slide for better judgment. Photographs are used in this study for assessing the facial attractiveness. Few studies²⁸ indicate that dynamic records are superior than photographs because emotional patterns can be examined and beauty judgments may differ. However, the dynamic recording approach is not widely utilised, and Rhodes et al³⁰ found in research that the judgments of facial attractiveness in video clips are comparable to those in static photos. Further studies in future still needed, evaluating the impact of eye colour, hair colour, eyebrows shape and size, and nose shape on facial attractiveness.

CONCLUSION

1. According to orthodontists smile, chin and nose were the most important factors contributing to facial attractiveness for females

and for males, smile, chin and skin were the contributing factors.

2. According to dentists, smile, skin and hairs contributes for facial attractiveness in females and in males smile, skin and eyes contributes for facial attractiveness.

3. While for layman, the smile and skin contributes most to facial attractiveness for both males and females.

DECLARATIONS

FUNDING

No grants or any other support funding were received for conducting this study.

CONFLICTS OF INTEREST

All authors have no conflicts of interest to declare.

ETHICS APPROVAL INFORMATION

Ethical approval was taken from the Institution Ethical Board Committee.

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