Original Article

Perception of Buccal Corridor Space on Smile Aesthetics among Specialty Dentist and Layperson

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ABSTRACT

Objectives: The aim of this study was to assess and compare the perception of smiles with and without buccal corridor spaces (BCSs) among prosthodontists, orthodontists and laypersons on smile aesthetics. **Materials and Methods:** Smiling photographs of subjects with wide BCSs were collected and digitally manipulated to eliminate the BCSs. Digitally altered and unaltered photographs were placed together and assessed for aesthetic appeal using visual analog scale of one to ten by prosthodontists, orthodontists, and laypersons. One-way analysis of variance (ANOVA) and two-way ANOVA were applied to evaluate the collected data using the Statistical Package for the Social Sciences (SPSS 22), Epi Info 6.0, and GraphPad Prism, version 6.0. **Results:** The total mean value scores of smiles with BCSs were significantly higher than those of smiles without BCSs ($P < 0.001$). Orthodontists and prosthodontists significantly appreciated BCSs and graded the smiles with BCSs to be much more attractive ($P > 0.005$). Laypersons rated the smiles with BCSs with greater mean values, but the difference in mean values of smiles with and without BCSs was not significant ($P < 0.005$). No significant difference was found between the perceptions of prosthodontists and orthodontists. **Conclusion:** The results of this study reveal that the smiles with BCSs were notably more desirable than the smiles without BCSs. Laypersons, orthodontists, and prosthodontists evaluated smiles differently. The smiles with BCSs were appraised much more pleasing by prosthodontists and orthodontists. Laypersons could not significantly appreciate BCSs, but rated smiles with BCSs as more acceptable.

KEYWORDS: *Aesthetics, buccal corridor spaces, orthodontists, prosthodontists, smile designing*

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INTRODUCTION

Aristotle exclaimed "Beauty is a greater recommendation than any letter of introduction." Aesthetics is a trump card for professional progress, social interactions, and to establish kinship with equally attractive people. Dental appearance is an integral component of facial aesthetics. An attractive smile is thus an asset but this could place a decided disadvantage economically, socially, and personally for those individuals with unattractive smiles.[1] Dentists can fashion a beautiful smile by smile designing. Smile designing is a systematic process that brings about some changes in hard- and soft-oral tissue within anatomical, physiological, and psychological limitations, thereby creating a positive effect on facial aesthetics and person's overall personality.[2] The change in trends and regional and ethnic liking make cosmetic surgery challenging for beginners and experienced professionals as well.[3] Dentistry, with its responsibility to produce ideal

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smiles, should reconsider the recent aesthetic approach keeping in account of previous data.[4]

Smile aesthetics is defined by the teeth, gums, and the number of gaps and spaces.[5] Commandments affecting smile aesthetics include arc of smile, symmetry, and ratio of maxillary central incisors; design of gingiva, gingival exposure, and buccal corridor; midline and angulation of tooth; color of tooth; and anatomic shape and volume of lip.[6]

The space conceived between the buccal surface of the posterior teeth and the corners of the lips when the patient smiles is known as the buccal corridor. It was calculated from the mesial line angle of maxillary first premolar to the inferior part of the commissure of the lip.[7] This aspect of smile aesthetics is also called lateral dark space, lateral negative space, or shadow tunnel.[6] Nascimento *et al.*[8] and Abu Alhaija *et al.*[9] concluded that the buccal corridor played a major influence on smile aesthetics.

The fundamental aspects in facial aesthetics are mouth and teeth. It is important to control the aesthetic effects caused by orthodontic and prosthodontic treatment, which is only possible by having the knowledge of the principles that manage the balance between soft tissues and teeth during smiling. The literature on ideal buccal corridor is based on clinical opinions, whereas research studies reveal controversial results. Therefore, more thorough studies are required on the details that can affect the aesthetic balance between teeth and soft tissues.[10]

"Beauty is in the eye of the beholder," implies that the eye for beauty is influenced by perception. The way in which a person can select, organize, and interpret input from their sensory receptors is perception.[2] It is the way in which something is regarded, understood, or interpreted. Different people have different perceptions and different interpretations of the same thing. Similarly, orthodontists, prosthodontists, and laypersons have varied perceptions. Laypersons are people who have completed their basic education but do not have any knowledge on the technical aspects of smile. The purpose of this study was to evaluate and compare perception of buccal corridor spaces (BCSs) on the aesthetics of smile among prosthodontists, orthodontists, and laypersons with the hypothesis that BCSs affected smile aesthetics and the perception varied among different groups of evaluators.

Materials and Methods

This research project was carried out for 6 months from January to June 2017, in Datta Meghe Institute of Medical Sciences after obtaining approval from the ethics committee of the institute (DMIMS[DU]/IEC/2016–17/6087). A group of 56 individuals consisting of 30 females and 26 males were selected for the study. The selection criteria included individuals aged 20–30 years, with a complete permanent dentition with or without third molars. They had no previous history of orthodontic treatment and possessed class I malocclusion as specified by Andrews[11] in his six keys. A perioral smiling photograph of each individual was captured using a digital camera (Nikon DSLR D5300: By Nikon). Each photograph was taken from a fixed distance of 90 cm without zooming in the presence of daylight, restricted from the ala of nose above to the chin below. Photo editing (software Photoshop version, 7.0; Adobe Systems, Adobe Photoshop: By Adobe Inc.) was used to convert the images to black and white and standardize them to a size of 1.25 × 2.5 inches with 100 pixel resolution.

After standardization, the width of BCSs was grouped as increased BCSs (dark corners), ideal BCSs, and no BCSs (Hollywood smile).[12] Five images that displayed ideal BCSs were selected for this study. The BCSs were digitally eliminated by adding images of teeth distally to the most visible tooth in the lateral aspects of smile. After these manipulations, the five original and five digitally altered images [Figure 1] were randomly mixed, numbered, and placed in a survey binder along with a questionnaire. The questionnaire was researched, self-structured and closed-ended time was provided to complete the questionnaire. The items for the questionnaire were generated from the following sources: theory, research, observation,

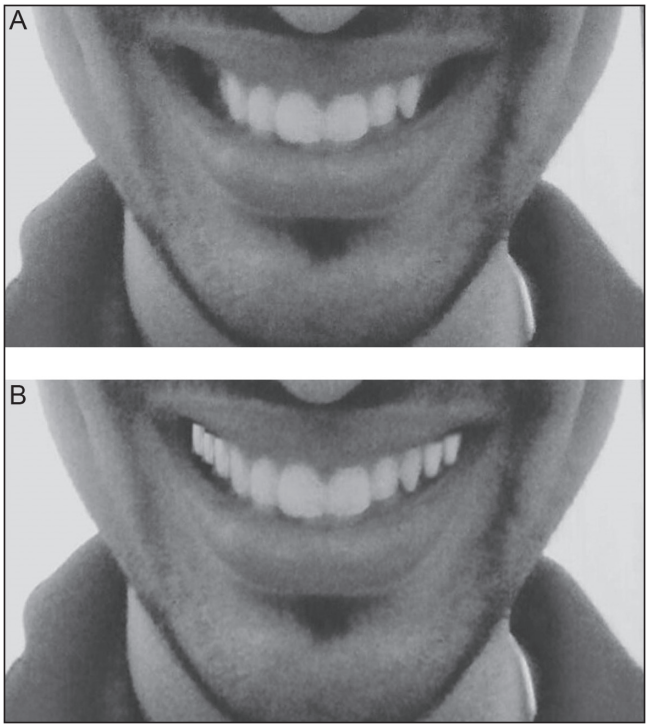

Figure 1: (A) Original photograph of one subject with buccal corridor spaces. (B) Digitally altered photograph where the buccal corridor spaces were eliminated

and expert opinion. Questions on BCSs to sensitize the assessor's attention toward BCSs and to reduce the influence of other factors affecting smile aesthetics along with age, gender, and occupation were mentioned in the questionnaire. The questionnaire was tested on a three-point Likert scale score with a 0–2 range. Before the start of the study, questionnaire was pretested for the validity and reliability. The questions were translated by the person expert in English and regional language (Marathi) and again back translated into English by another expert. The face and content validity were assessed by subject experts and institutional school. The questionnaire was further tested for internal consistency by Cronbach's alpha, which gave a value of 0.82.

The sample size was calculated using $n = 2SP^2 [Z_{\alpha/2} + Z_{\beta}]^2/d^2$. A total of 89 individuals consisting of 37 laypersons, 16 orthodontists, and 38 prosthodontists were recruited as subjects. Perception of general dentists was not considered for the study as aesthetics is emerging majorly as a specialist domain. The survey was distributed to the subjects and their perceptions regarding the BCSs were assessed by asking them to evaluate the attractiveness of smile in the altered and unaltered photographs using visual analog scale (VAS) score from zero to ten; zero being least attractive and ten being most attractive.

Statistical Analysis

The mean scores of VAS were calculated using the software Statistical Package for the Social Sciences (SPSS, IBM Corporation) version 22.0, Epi Info, Centres for Disease Control and Prevention (CDC) in Atlanta, Georgia (US) version 6.0, and GraphPad Prism, GraphPad Softwares,Inc. version 6.0 for each group and were entered on to an Excel Spread Sheet (Microsoft Word 2010, Microsoft). One-way analysis of variance (ANOVA) and two-way ANOVA were applied to evaluate the collected data.

Results

A questionnaire on BCSs appraised the awareness of BCS among the different groups. A frequency response in Table 1 highlighted the same. Around 75 of total 89 evaluators had observed dark spaces in the corner of mouth while smiling and 55 of them believed that it made the smile more pleasing. The mean scores of

Table 1: Frequency response of subjects regarding buccal corridor space

Variable	Response	Total	Profession		
			Laypersons	Prosthodontists	Orthodontists
Have you observed dark space in corners when people smile	Do not know	2	2	0	0
	No	12	8	2	2
	Yes	75	25	36	14
Does the dark space while smiling make it more attractive	Do not know	12	12	0	0
	No	22	2	13	7
	Yes	55	21	25	9

Table 2: Comparison of mean scores among three groups by analysis of variance

Variable	Profession	*N*	Mean	Std. deviation	Std. error	*F* value	*P* value
Have you observed any black/dark spaces in the corner of mouth when people smile?	Layperson	35	0.71	0.46	0.08	4.027	0.021*
	Prosthodontists	38	0.95	0.23	0.04		
	Orthodontists	16	0.88	0.34	0.09		
	Total	89	0.84	0.37	0.04		
Does the appearance of dark spaces make the smile of a person more attractive?	Layperson	35	0.06	0.24	0.04	6.538	0.002*
	Prosthodontists	38	0.34	0.48	0.08		
	Orthodontists	16	0.44	0.51	0.13		
	Total	89	0.25	0.43	0.05		

*Statistically significant

Table 3: *Post hoc* tests by Least Significant Difference (LSD) test

Dependent variable	Profession	Profession	*P* value
Have you observed any black/dark spaces in the corner of mouth when people smile?	Layperson	Prosthodontists	0.006
		Orthodontists	0.136
	Prosthodontists	Orthodontists	0.495
Does the appearance of dark spaces make the smile of a person more attractive?	Layperson	Prosthodontists	0.004
		Orthodontists	0.003
	Prosthodontists	Orthodontists	0.436

which were further evaluated by ANOVA and *post hoc* analysis [Tables 2 and 3].

Smiles with BCSs were rated notably more desirable than smiles without BCS (P = 0.001) [Table 4]. Prosthodontists, orthodontists, and laypersons gauged the VAS scores for smile attractiveness with and without BCS differently [Tables 5 and 6]. The mean scores obtained for smiles without BCSs were 13.53 and 13.63 for prosthodontists and orthodontists, respectively. Comparatively, the values evaluated for smiles with BCSs were 29.76 and 30.31 for prosthodontists and orthodontists, respectively. Thus, orthodontists and prosthodontists significantly appreciated BCSs and graded smiles with buccal corridor much more attractive than smiles without BCS ($P > 0.005$). For laypersons, the mean score calculated for smiles without BCSs was 26.51, whereas for smiles with BCSs, it was 30.31. Hence, laypersons rated smiles with BCSs with greater mean values, but the difference in mean values of smiles with and without BCSs was not significant ($P < 0.005$). No appreciable difference was found between the perceptions of prosthodontists and orthodontists.

Discussion

In modern dental practice, a highly aesthetic treatment outcome is being demanded by a large number of patients.[13] Smile has an indispensable role in facial aesthetics. It also determines the perception of one's psychological characteristics. Negative changes may influence a person's intelligence, emotional stability, personality, dominance, and sexuality.[6] A patient reporting for dental treatment with chief aesthetic complaint indirectly seeks treatment for the psychological issues associated with an unaesthetic smile. A detailed scrutiny of the factors affecting smile is thus important to improve the psychological status and the quality of life of patient.

Numerous studies studying smile aesthetics have assessed the role of various influencing parameters such as smile line, gingival display, and facial and dental midline but few have sought to study BCSs. Smile aesthetics varied greatly in the manner in which the image was presented.[14] Some authors have used full face images in which the mouth occupied a small component of the total area.[15,16] This may distract the viewer from the variable being examined, and may alter results. To further reduce biasness associated

Table 4: Mean value scores of smiles without and with buccal corridor space

Variable	*N*	Mean	Std. deviation	*P* value
Smiles without buccal corridor	89	18.65	6.65	0.001*
Smiles with buccal corridor	89	29.96	2.02	

*Statistically significant

Table 5: Mean visual analog scale scores for smile attractiveness with and without buccal corridor spaces among laypersons, orthodontists, and prosthodontists

Group		*N*	Mean	Std. deviation	*P* value
Layperson	Without buccal corridor	35	26.51	1.63	0.052
	With buccal corridor	35	30.00	2.04	
Prosthodontists	Without buccal corridor	38	13.53	2.20	0.000*
	With buccal corridor	38	29.76	1.78	
Orthodontists	Without buccal corridor	16	13.63	1.89	0.000*
	With buccal corridor	16	30.31	2.55	

*Statistically significant

Table 6: *Post hoc* analysis by least significant difference (LSD) of mean scores for smile attractiveness with and without buccal corridor spaces among laypersons, orthodontists, and prosthodontists

Dependent variable	Profession	Profession	Significance
Without buccal corridor	Layperson	Prosthodontists	0.000*
		Orthodontists	0.000*
	Prosthodontists	Orthodontists	0.986
With buccal corridor	Layperson	Prosthodontists	0.884
		Orthodontists	0.879
	Prosthodontists	Orthodontists	0.665

*Statistically significant

with selecting representative populations due to other confounding factors such as lip and teeth color, gingival display, and smile line, this study featured black and white images restricted only to the oral region, and each smile was evaluated twice, one with BCSs and one altered to eliminate BCSs.[12]

The questionnaire filled by the evaluators before grading of the smile photographs revealed that most of the people in all the three groups had noticed the appearance of black space in the corner of mouth when people smiled and believed that it made the smile adorable.

Smiles with BCSs were classed superior than smiles without BCSs. The results obtained were similar to those by Nimbalkar *et al.*[15] who observed that a medium buccal corridor (15%) was the aesthetic characteristic preferred by Chinese, Malay, and Indian groups of evaluators in short, normal, and long face types. Abu Alhaija *et al.*[9] and Nascimento *et al.*[8] concluded that the buccal corridor played a major influence on smile aesthetics. It was contrary to the findings by Daltro Eneas *et al.*[10] and Hulsey *et al.*,[17] who indicated that the presence or absence of BCSs was not an aesthetic issue.

As perception was a subjective phenomenon, several studies have compared the perceptions of laypersons and dentists.[9,18] This study was unique in a way that it affirmed the varied perceptions of prosthodontists, orthodontists, and laypersons. Prosthodontists and orthodontists usually work in a multidisciplinary team to provide treatment to laypersons, who report as patients. This study confirmed the difference in perception between the three groups.[18] The professionals may judge according to aesthetic guidelines and develop concepts of an aesthetic appearance that may differ from the laypersons. This would lead to theoretically achievable results, but might not fulfill the patients' expectations as high expectations and standards influence the perception of the outcome of dental treatment.[19] Thus, an integration of perceptions was a paramount objective for obtaining aesthetically pleasing results, which leads to optimum satisfaction of the patient and the professional.

This research identified that laypersons were less discriminating than orthodontists and prosthodontists in their perception of BCSs. This can be accounted due to the fact that laypersons are not trained to focus on smile, making them less critical to minute variables, which bring aesthetically better results. The results obtained were similar with the findings by Afsari and Niksolat[20] who confirmed the effect of professionals—orthodontists, prosthodontists, dental, and non-dental students in influencing their point of view. Al Taki *et al.*[21] found that orthodontists were more exact and perceptive in accepting variations in the arc of smile and buccal corridors. Sridharan and Samantha[22] showed that the mean scores given by orthodontists are lesser than those given by non-orthodontists. The findings were contrary to the findings by Rajeev *et al.*[23] who observed that no difference of perception was reported between general dentists and laypersons in evaluating BCSs.

Thus, on the basis of the results obtained, it can be laid down that different people viewed the same thing differently. Laypersons were concerned with aesthetically better results but they could not appreciate the minute changes in the BCSs, which brought about that difference in aesthetics. This highlights the importance of the minute spaces of BCSs in patients' perseverance of an aesthetic smile. Accordingly, the clinician can appreciate and incorporate BCSs in prosthodontic and orthodontic procedures that will bring aesthetically more appealing results, leading to better patient satisfaction. Thus, preventing the patient from embarrassment and psychological trauma of an unaesthetic smile and improve the self-esteem and quality of life of the patient.

A small sample size remains the limitation of the study. As the study was questionnaire based, more concrete results can be validated by other objective measurements. Perception is also seen to vary with age of evaluators as concluded by Sriphadungporn and Chamnannidiadha.[24] Further study comparing the perception in multiple ethnic groups of different age groups along with the incorporation of photographs displaying narrow and medium BCSs is suggested.

Conclusion

The results of the study reveal that smiles with BCSs were judged to be more aesthetic by laypersons, orthodontists, and prosthodontists. The three groups evaluated smiles differently. It was assessed that smiles with BCSs were much more pleasing for prosthodontists and orthodontists. Even though laypersons could not appreciate BCSs, they rated smiles with BCSs to be aesthetically more acceptable. The integration of BCSs in smile designing will help achieve optimum aesthetic results and ultimately contribute in enhancing the patient's smile, appearance, and subsequently their self-confidence.

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Conflicts of interest

There are no conflicts of interest.

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