

THE IMPACT OF VARIATIONS IN SMILE ARCS AND BUCCAL CORRIDORS ON SMILE ESTHETICS AS RATED BY ORTHODONTISTS, GENERAL DENTISTS AND LAYPERSONS

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Abstract

Introduction: Occlusal treatment was focused in orthodontics for a long period of time. However, in modern orthodontics, evaluation of smile esthetics is of prime importance. The objective of this study was to determine the impact of smile arc and buccal corridors on smile attractiveness, and to compare the perception of orthodontists, general dentists and laypersons of these variables.

Materials and Methods: This study was based on a closeup smiling photograph of a young female exhibiting posed smile with no obvious facial or dental defects. The buccal corridors (BC) and smile arc were altered using Adobe Photoshop® version CS4 (Adobe Systems, San Jose, California, USA). All photographs were rated by orthodontists, general dentists and laypersons for attractiveness with a visual analog scale (1-10).

Results: Our results showed that orthodontists, general dentists and lay people rated smiles with small BCs and consonant smile arc as significantly more attractive than those with large BCs and flatter smile arcs ($P < 0.05$). However, orthodontists were better to detect small changes in BC's and smile arc than general dentists and laypeople.

Conclusion: All participants preferred smile with consonant smile arc and minimal BC's. However, laypeople perceived changes in smile arc and BCs differently than the other two groups. Orthodontists and general dentists were better in detecting mild changes in BCs and smile arc than laypeople.

Key Words: Smile arc, buccal corridors, posed smile

Introduction

In everyday life, eyes and smile of an individual are given more significance than facial esthetics.¹ According to Goldstein¹ smile ranks second to the eyes in facial esthetics in the mind of general population. Occlusal treatment was the main focus in early era of orthodontics. However, in modern orthodontics, evaluation of smile esthetics has been given more significance.^{2,3,4} In fact, creating attractive smile is now one of the fundamental goals of orthodontic treatment.^{3,5,6}

Previous literature showed ethnic variations in perception of smile attractiveness between different populations.⁷ According to Peck and Peck and Oumeish² culture, income and age influencing the beauty standards, implies that ideals of beauty are always changing. Mcleod and Fields⁷ found significant differences in the preference of the smile characteristics between Canadian and US laypersons.

Understanding the factors that help or harm the attractiveness of smile is an important step in creating attractive smile.^{2,8} Smile arc and buccal corridors are two important variables affecting smile esthetics.^{3,4,5}

Smile arc is defined as the relationship of maxillary incisor edges and canine tips to the curvature of lower lip in a posed smile.³ Frush and Fisher³ proposed that in ideal smile, there should be harmony between the curvature of the incisal edges of the maxillary anterior teeth and the curvature of lower lip. Husley² found in his study that an orthodontically treated patient has flatter smile arc than an untreated patient.

Buccal corridor is a space between the buccal surfaces of maxillary teeth and the corner of mouth during smile.⁶ Previous research showed conflicting results regarding impact of buccal corridors on smile esthetics. Frush and Fisher³ stated that the presence of buccal corridors gives illusion of natural dentition but its absence gives artificial appearance. Moore et al³ noted that broader smile with absence of buccal corridors are more attractive than smile with BC's. Sarver and Ackerman⁴ reported that orthodontic expansion of maxillary arch improves smile attractiveness.

A difference in smile perception also exists in different socioeconomic and professional groups. Kokich et

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al¹⁰ found that the orthodontists, dentists and the laypersons perceive changes in smile characteristics at different threshold level, and the laypersons were more forgiving. Johnston et al⁵ also noted a difference between orthodontists and layperson ratings.

Limited research is available on perception of smile in our population. Also, a possible variation in perception of smile between different groups may result in different treatment objectives and possibly, treatment planning. Therefore, the objectives of this study are to determine the impact of variation of smile arc and buccal corridors on smile attractiveness, and compare the way orthodontists, general dentists and laypersons perceive smile arc and buccal corridors.

Materials and Methods

Approval for the present study was obtained from the ethical committee, Gandhara University, Peshawar. This study was based on a closeup smiling photograph of a female exhibiting posed smile with permanent dentition intact and no obvious facial or dental defects. The image was bisected and mirrored to eliminate any minor smile asymmetry by using Photoshop (CS2; Adobe Systems, San Jose, California, USA). Smile arc and buccal corridors were altered using Adobe Photoshop® version CS4 (Adobe Systems, San Jose, California, USA). Distractors such as part of the nose, cheeks, skin color, and any blemishes or facial hair were minimized.

The curvature of the incisal edges were modified with adobe photoshop version CS4 to fit eight curves ranging

Figure 1. Various categories of smile arc.



from flat to exaggerated consonant, based on sequentially increasing parabolic arcs in 0.5mm increments in midline.

Buccal Corridors were expressed as a percentage of the dark space between visible maxillary dentition and inner commissures divided by inter-commissure width. Eight different categories of following BCs were created as follows;

full- broad smiles (0%), extra-broad smiles (4%), broad smiles (8%), medium broad smiles (12%), medium smiles (16%), medium narrow smiles (20%), narrow smiles (24%), extra-narrow smiles (28%).

These images were displayed randomly on A-4 size paper. All the photographs were rated by orthodontists, general dentists and laypersons for attractiveness with a visual analogue scale

from very unattractive" (scale rating,1) to "very attractive"(scale rating,10). Figure 1 and 2 show various categories of smile arc and buccal corridors, randomly displayed on paper.

Statistical analysis

Standard descriptive statistics (means, standard deviations, and ranges) were calculated for different groups. ANOVA was used to compare different groups. All statistical tests in this study were performed with the aid of a statistical software program (SPSS; Statistical Package for the Social Science for Windows, version 12.0, Chicago, Ill). A P-value less than .05 was considered as statistically significant.

Figure 2. Various categories of buccal corridors.



Results

Figure 3 illustrates the preference of the various categories of smile arcs as rated by different groups. All participants preferred the consonant smile arcs compared to the flat smile arcs. Flat smile arcs were rated significantly un-attractive.

Similarly, Figure 4 depicts the preference of the various categories of buccal corridors by different groups. Broad (8%) and extra-broad (4%) smiles were highly rated as compared to full-broad (0%), medium and narrow (>8%) smiles.

Table 1 shows the comparison of ratings of smile arcs by different groups. Orthodontists and general dentists were more sensitive to mild changes in smile arc as compare to laypersons. The laypeople also rated mildly flatter smile arcs as fairly high while orthodontist and general dentists rated them unesthetic.

Table 2 shows the comparison of buccal corridors as rated by different groups. Laypeople preferred a wider range of buccal corridors as esthetically acceptable than orthodontists and general dentists.

Figure 3. Overall ratings of Smile arc by different groups

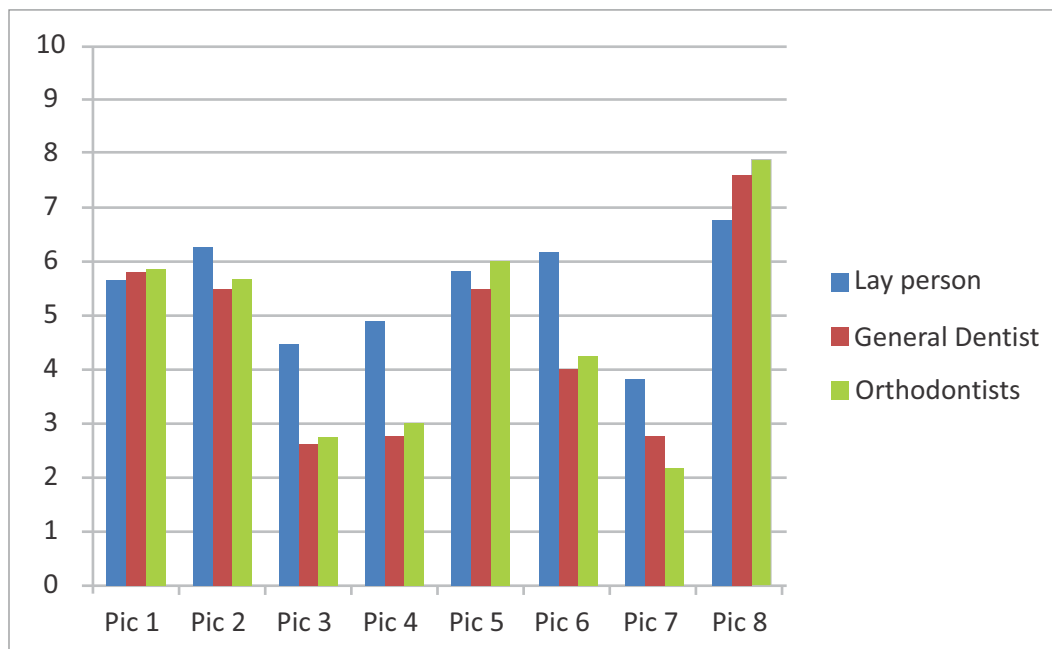


Figure 4. Overall ratings of Buccal Corridors by different groups.

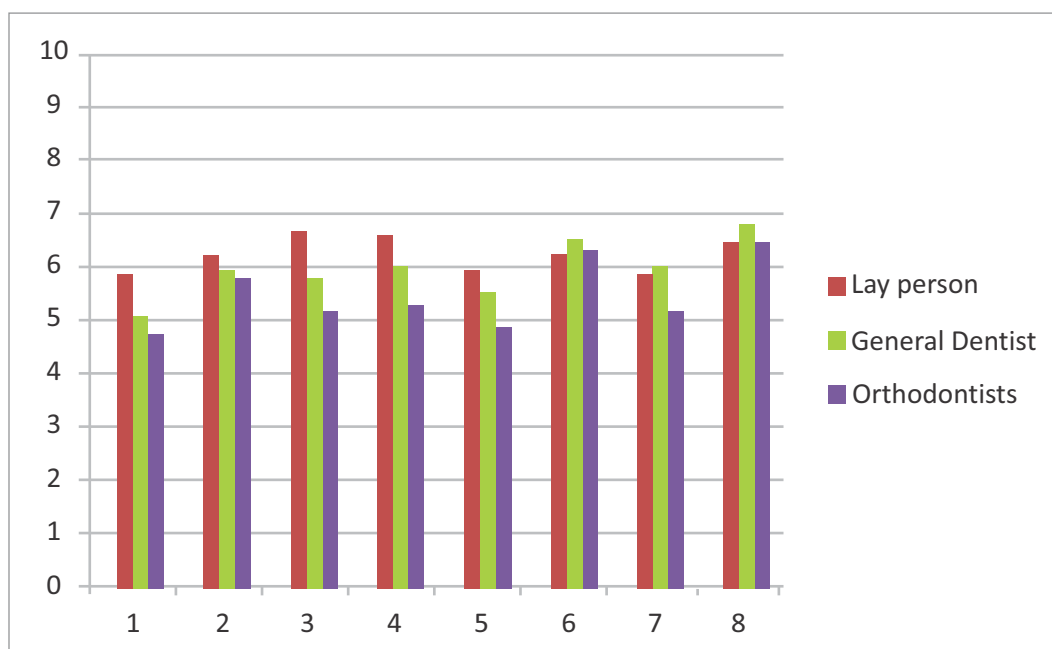


Table.1: Comparison of group ratings for various categories of smile arcs, having significant differences. (S/A; Smile arc, LP; Laypeople, GD; General Dentist, OR; Orthodontist)

S/A	LP	GD	OR	P Value
Pic 3	4.48	2.6	2.75	.000
Pic 4	4.93	2.76	3.01	.000
Pic 6	6.21	3.98	4.33	.000
Pic 7	3.83	2.78	2.18	.001
Pic 8	6.78	7.61	7.9	.017

Table 2: Comparison of different group ratings of buccal corridor categories having significant differences. (B/C; Buccal corridors, LP; Laypeople, GD; General Dentist, OR; Orthodontist)

B/C	LP	GD	OR	P Value
Pic 1	5.81	5.03	4.73	.050
Pic 3	6.65	5.78	5.15	.001
Pic 4	6.58	5.95	5.28	.002
Pic 5	5.91	5.53	4.85	.007

Discussion

The lips and teeth have fundamental role in facial esthetics,^{5,6} and their position can be altered by orthodontic treatment.⁸ Therefore, it is important to control the effects of orthodontic treatment on facial esthetics, which is only possible by knowing the factors that can affect the balance between teeth and soft tissues during smile.⁸ Smile arc and buccal corridors are two main aspects of smile esthetics.^{2,3,4,5,7,8,9}

We used visual analogue scale to quantify the attractiveness of smile arc and buccal corridors, which is widely used for measuring subjective data.^{9,11-18} It is a simple, quick, reliable method for judging the attractiveness by raters using a continuous scale, without categorizing the variables.^{15,19} Moderately high correlation coefficients for reliability have been reported with the use of the VAS in evaluating dental attractiveness.¹⁹

All participants in our study preferred smile arc that is lightly touching and parallel with the lower lip. A slight change in smile arc curvature has drastic effect on smile, which may not be un-noticed by observers. All raters preferred broader smiles with minimal buccal corridors. Both excessive (>8%) and absent (0%) buccal corridors can make smile unattractive.

Hulsey²⁰ found that ideal smile arcs had higher ratings, which agree with our findings. He suggested that a flat smile arc significantly reduces the attractiveness of smile. However, Hulsey's²⁰ study did not find any impact of buccal corridors on smile attractiveness. The raters in our study preferred minimal buccal corridor as more esthetic. It might be due to 'small

buccal corridors' in Hulsey's study, that were not properly detected by raters. Yoon et al²¹ performed a similar study in Korea and found higher esthetic scores for ideal smile arcs as well as for smiles displaying a greater number of teeth. This is in agreement with our study, in which participants also preferred smile arc that is parallel to curvature of lower lip.

Our study contradicts the study of Roden-Johnson et al,¹¹ who found no significant difference in female smiles with and without buccal corridors when judged by orthodontists, general dentists, and laypersons. This may be due to difference in our different methodologies. Roden-Johnson et al¹¹ classified buccal corridors as present or absent. It is possible that their buccal corridors might be too small to elicit a negative response. Moore et al²² found that laypersons were able to distinguish differing levels of buccal corridor and preferred broader smiles with minimal buccal corridors. Our findings agree with that of Moore et al²² study, where layperson prefer minimal buccal corridors. However, they examined a wider range of corridor sizes than general dentists and orthodontists.

The normal buccal corridor size in Ritter et al study was 9.60%,⁹ which is close enough to the value in our study. However, their study did not show any significant difference between orthodontist and layperson rating.

A flat smile arc will significantly reduce the attractiveness of smile.² All raters prefer a consonant smile, with incisal edges parallel and lightly touching the lower lip. The orthodontists and general dentists were better in detecting in slight changes in smile arc than laypersons.

The clinician should avoid flattening of smile arcs and complete obliteration of buccal corridors during treatment. These goals can be achieved by carefully planning treatment and by attending to arch form, the inclination of the occlusal plane, and anterior vertical tooth position, especially during finishing.

Conclusion

We evaluated the impact of smile arc and buccal corridor on aesthetic perception. We also evaluated the difference in rating between orthodontists, general dentists and laypersons. Our study showed following results.

- Orthodontists, general dentist and laypeople rated smiles with small BCs and consonant smile arc as significantly more attractive than those with large BCs and flat smile arcs.
- Mild flattening of smile arc can drastically affect the smile esthetics.
- All raters preferred fuller smiles.
- Orthodontists and general dentists were better at detecting mild changes in BCs and smile arc than laypeople.

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