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## Buccal Corridors: A Fact or a Myth in the Eyes of Laymen?

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### Abstract

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**AIM:** This study aimed to investigate laymen knowledge of the existence of the buccal corridor and whether it was an important factor for them in judging smile attractiveness and the effect of introducing the knowledge to them on their further judgment.

**MATERIALS AND METHODS:** Nine subjects were randomly selected with variable buccal corridor percentages. They were coached to smile in a posed fashion and full face smile photographs were taken from a standardised distance. The photographs were randomly arranged in a power point presentation and displayed to a panel of thirty-nine randomly selected laymen judges. The judges made their beauty judgment on a visual analogue scale (VAS) and filled a questionnaire. After their education about the buccal corridor, they were asked to make a second judgment on a second sheet with VAS and with a different random sequence of the photographs.

**RESULTS:** Intra-class correlation agreement for all the judges between the first and second scores was 0.713. The Spearman's rho Correlation coefficient indicated a positive correlation for all the photos. For the male judges, the agreement between the ratings was 0.839, and the correlation was positive for all the photos. For the female judges, the agreement between the ratings was 0.510, and the correlation was positive for all the photographs. Hundred percent of the judges were not familiar with the buccal corridor. Eighty percent of the female judges and 44.4% of the male judges mentioned that it would affect their further judgment.

**CONCLUSION:** Laymen build their esthetic judgments on what we teach them, and modifying treatment plans to include corrections of buccal corridors for esthetic reasons only is a myth.

## Introduction

Beauty, in general, has often been defined as the harmony of proportions; which largely depends on upon subjective feelings and interpretations of observers. Cultural factors, which change over time, play a significant role. In addition, the diversity of ethnic backgrounds [1-3] and education affect the esthetic judgment of different populations.

Smile attractiveness was the point of research for scientists seeking to create a marriage of science and emotion in their orthodontic or esthetic treatment plans. They investigated many smile traits; some of which were the smile arc [4, 5], the smile line [6], the amount of gingival display and gingival smile line [7-9].

The buccal corridor gained special attention in

the past and was described by Frush and Fisher [10] as the space between the buccal surfaces of posterior teeth and the corners of the lips on smiling. Frush and Fisher argued that proper size buccal corridors were important to prevent the "denture" appearance created by broad smiles. With the passage of time, the buccal corridor remained as an important point of investigation for many researchers owing to the internationally growing demand for high esthetic standards. The fact that the perception of what was attractive or natural looking had changed over time led to the general belief that the display of more teeth during smiling was more attractive, and that broader smile were much more preferred [11-14].

Throughout the years, the main interest of researchers was confined to finding the proper size of the buccal corridors perceived by laymen [3, 13, 15-18] and/ or orthodontists [2, 12, 14, 16, 18], without questioning whether people noticed it in the first place

or not.

This study investigated, for the first time, the attractiveness of the smile twice; once before introducing laymen to the buccal corridor and another time after it. Accordingly, the aim was to investigate laymen knowledge of the existence of the buccal corridor and whether it was an important factor for them in judging smile attractiveness and the effect of introducing the knowledge to them on their further judgment.

## Materials and Methods

The study included nine subjects which were randomly selected by a participant in the research other than the one conducting it. They all had complete natural dentition with no rotations, no gingival inflammation or gingival recession, no previous orthodontic treatment, no spacing, and straight teeth or minimal crowding 1-2 mm.

The subjects had variable buccal corridor percentages. The percentage was calculated as the ratio between the measurement of the visible maxillary teeth and the width of the inner lip commissure multiplied by 100 [12-14, 18]. Buccal corridor of 28% was considered wide, 15% was considered a medium buccal corridor, and 0-2% was considered as a broad smile with no buccal corridors [12-14, 18]. Three subjects were chosen for each percentage (Figure 1).



Figure 1: Different buccal corridor percentages

The subjects were coached to smile in a "posed" fashion without laughing or straining [19] and to achieve the same lip configuration at least twice successively before any photographs were taken [8, 20]. Full face photographs, in the natural head position [21], were taken with a 35 mm digital camera and 100mm focal length, mounted on a tripod at a standardised distance of 120 cm for all subjects.

The natural head position was determined as follows [21]:

1. The interpupillary line was parallel to the horizontal plane.

2. The distance from the outer canthus of the eye to the hairline was equal on each side.
3. The line from the outer canthus of the eye to the superior attachment of the ear (C-SA line) parallel to the horizontal plane was used to prevent tilting of the head.

Ethical approval from the National Research Centre, Medical Research Ethics Committee, and registration number 16025 was obtained.

All the subjects' eyes were covered using Adobe Photoshop 7.0 (Adobe systems, San Jose, Calif). They all signed an informed consent that their photographs would be used for research purposes.

For generating a concealed allocation sequence, each photograph was saved in a separate computer folder and numbered. Using Random sequence generator online software (www.random.org), the sequence of the photographs was determined. They were included in a power point presentation, (Microsoft office 2010), in the same determined random sequence. The whole process was executed by the participant who randomly selected the nine subjects in the first place.

A questionnaire (Figure 2) and a 10 mm visual analogue scale (VAS) were formulated to serve the study aim. The anchors of the VAS were: attractive, and unattractive [18].

Judge's gender:

Judge's age:

A) On what aspect of the smile did you make your judgment?

- i) Teeth alignment
- ii) Amount of incisor display on smiling
- iii) Relation between teeth and lips
- iv) Amount of gingival display on smiling
- v) Others

B) Are you familiar with the buccal corridor? Yes No

The Buccal corridor is the triangular black space between the last appearing tooth the lip commissure on smiling

A) Did it affect your judgment by any means? Yes No

B) If NO, do you think it will affect your judgment in the future now you're aware of it? Yes No

Figure 2: Questionnaire

Thirty-nine laymen judges (18 males, 21 females) were randomly selected on the basis of their lack of dental or esthetic education. Their age ranged from 20 to 30 years. They all were university graduates who worked in the educational or business fields.

To calculate the sample size, a pilot study was conducted on 10 laymen judges other than those participating in the research. A minimum of 16 males and 16 females were found to be sufficient to detect the correlation between the two judgment scores, with

a power of 90 % and error = 0.05; using G\*power version 3.1.9.2.

The presentation was displayed for the judges to rate the photographs by the VAS; each photograph was displayed for 15 seconds and returning back to previous photographs was not an option [18]. Each judge was then handed a questionnaire to answer, they were all asked to indicate their age and gender on the questionnaire paper (Figure 2).

The questionnaire was designed such that to find out on what aspect of the smile they based their judgment and whether they were familiar with the buccal corridor or not. Then, they were introduced to the term "buccal corridor", and were asked if it affected their judgment, and whether it would affect any future smile attractiveness judgment now that they became aware of it.

After the questionnaires were filled another sheet with a visual analogue scale was handed to the panel of judges for a second smile attractiveness judgement, provided that the photographs displayed in the second presentation were randomly re-ordered using Random sequence generator ([www.random.org](http://www.random.org)) to ensure the absence of bias. This second rating was done to confirm or negate their answers in the questionnaire.

Intra-class correlation (ICC) used to quantify the reliability between the two ratings for the same Candidate, and Spearman's rho Correlation coefficient was calculated for the total judgment panel and for the male and female judges. Frequency and percentages for the Answers and comparisons between male and female judges were done. The difference between males and females for questionnaire results were assessed using Kruskal-Wallis for the first question and Chi Square for the other three questions. Statistical significance was set at  $P < 0.05$ . Statistical analysis was performed using IBM® SPSS® (SPSS Inc., IBM Corporation, NY, USA) Statistics Version 22 for Windows.

## Results

The intra-class correlation between the first and second ratings for the whole judgment committee was 0.713. There was a positive and significant Spearman's rho correlation for all the photographs (Table 1). For the male judges, the agreement between the first and second ratings was 0.8395, and the correlation was positive and statistically significant for all the photographs (Table 2). For the female judges, the agreement was 0.50975 while the correlation was also positive for all the photographs and statistically significant for most of the photographs (Table 3).

**Table 1: Intra-class correlation (ICC) between the 2 scores for all the judges and Spearman's rho Correlation coefficient**

Photographs	ICC	95% Confidence Interval		Spearman's rho Correlation coefficient	P-value
		Lower Bound	Upper Bound		
1	0.825	0.666	0.908	0.721	≤0.001*
2	0.797	0.613	0.893	0.083	≤0.001*
3	0.755	0.534	0.871	0.644	≤0.001*
4	0.621	0.285	0.800	0.518	0.001*
5	0.654	0.348	0.817	0.513	0.001*
6	0.588	0.215	0.784	0.477	0.002*
7	0.686	0.394	0.837	0.466	0.003*
8	0.779	0.575	0.885	0.598	≤0.001*
Mean	0.713				

\* = significant. P-value =  $p < 0.05$ .

There was an insignificant difference between the answers of the first question;  $p=0.967$ . In addition, 100% of the judges were not familiar with the buccal corridor. 71.4% of the female judges mentioned that the buccal corridor didn't affect their judgment, initially, compared to 50% of the male judges.

**Table 2: Intra-class correlation (ICC) between the 2 scores for the male judges and Spearman's rho Correlation coefficient**

Photographs	ICC for males	95% Confidence Interval		Spearman's rho Correlation coefficient	P-value
		Lower Bound	Upper Bound		
1	0.938	0.836	0.977	0.919	≤0.001*
2	0.927	0.804	0.973	0.851	≤0.001*
3	0.919	0.785	0.97	0.810	≤0.001*
4	0.878	0.672	0.955	0.877	0.001*
5	0.562	-0.194	0.837	0.498	0.035*
6	0.791	0.444	0.922	0.688	0.002*
7	0.791	0.420	0.925	0.562	0.019*
8	0.910	0.749	0.967	0.808	≤0.001*
Mean	0.839				

Only 44.4% of the male judges mentioned that their introduced knowledge about the buccal corridor would affect their future judgment compared to 80% of the female judges (Table 4).

**Table 3: Intra-class correlation (ICC) between the 2 scores for the female judges and Spearman's rho Correlation coefficient**

Photographs	ICC for females	95% Confidence Interval		Spearman's rho Correlation coefficient	P-value
		Lower Bound	Upper Bound		
1	0.710	0.269	0.883	0.550	0.01*
2	0.515	-0.094	0.796	0.559	0.008*
3	0.447	-0.323	0.773	0.455	0.038*
4	0.193	-0.918	0.667	0.179	0.437
5	0.734	0.364	0.891	0.512	0.018*
6	0.392	-0.342	0.745	0.477	0.002*
7	0.553	-0.130	0.82	0.364	0.114
8	0.534	-0.166	0.812	0.332	0.141
Mean	0.510				

\* = significant. P-value =  $p < 0.05$ .

## Discussion

In order to provide a totally non-biased environment for conducting the study, full face photographs were taken in accordance to validation [22] who suggested that laymen assessment of the buccal corridor differed on judging full faces rather than just the smiles. Moore et al [13] also suggested that when full faces were taken into consideration the

sizes of the buccal corridor affected smile attractiveness. Further, different subjects were used for the photographs in this study in contrast to manipulating a single photograph as in other studies [13, 18, 22]. This was done to provide real life simulation which enhanced the judges' precision.

**Table 4: Frequency and percentage for the Answers and comparison between Male and Female judges**

		Gender of judges				p-value
		N	Male %	N	Female %	
1. On What Aspect of the smile did you make your judgment?	i) Teeth alignment	5	27.8%	2	9.5%	0.967
	ii) Amount of incisor display on smiling	1	5.6%	4	19.0%	
	iii) Relation Between teeth and Lips	4	22.2%	7	33.3%	
	iv) Amount of the gingival display on smiling	1	5.6%	2	9.5%	
	v) Other's	7	38.9%	6	28.6%	
2. Are you Familiar with the buccal corridor?	Yes	0	0.0%	0	0.0%	NA
	No	18	100.0%	21	100.0%	
3. Did it affect your judgment by any means?	Yes	9	50.0%	6	28.6%	0.170
	No	9	50.0%	15	71.4%	
4. If No, do you think it will affect your judgment in the future now you're aware of it?	Yes	4	44.4%	12	80.0%	0.074
	No	5	55.6%	3	20.0%	

\* = significant. NA=not applicable. P-value= p<0.05.

When the research was concluded and the data was analysed statistically, one of the nine subjects chosen to be judged had an extreme variation in his scores among all the judges, and thus was discarded from the analysis. This extreme variation in scores was suggested to be due to the presence of a beard on the male subject in the photograph, which affected people's judgment variably.

From the results, it was found that laymen lacked any knowledge of what is a buccal corridor and were not familiar with its esthetic impact in all the subjects.

Of the whole judgment committee, 71.4% of the female judges answered that the buccal corridor didn't affect their judgment by any means, even though they had no knowledge of it, while only 50% of the males mentioned it didn't affect their judgment at all.

When the first and second ratings given to the photographs were compared, the total judgment committee showed no agreement between the two scores; 0.713. This indicated that after they were introduced to the knowledge their judgement had changed and that knowledge had an impact on them; which was a positive impact with an increase in overall ratings regardless of the size of the buccal corridor. This incidence demonstrated that even with their introduced new knowledge laymen were not able

to distinguish the impact of different buccal corridor sizes on smile esthetics. This was in contrast to Moore et al [13], Martin et al [16], and Zange et al [18], and similar to Hulsey [4], and Parekh et al [14], however, they made their judgment regarding smile arc in conjunction to buccal corridors so the judgment regarding buccal corridors solely was compromised.

Furthermore, Hulsey [4] didn't consider the buccal corridor as mentioned by Frush and Fischer [10]; they only considered it as the ratio of the distance between the canines and the width of the smile, which was not a true buccal corridor. Besides, Hulsey [4] conducted his study using photographs limited to the mouth region while in this study full face photographs were used.

All the previously conducted studies determined the proper size of the buccal corridor without mentioning how the laymen were introduced to it and whether they were instructed to differentiate between the different sizes or it was left for their ratings to determine it [1, 11, 13-18].

The male judges showed a good agreement; 0.8395, between the first and second ratings. However, still, the correlation was positive with a significant increase in overall ratings, despite that only 55.6% of the males mentioned that the knowledge of the buccal corridor would not affect their judgment. This was an indication that male judges were somehow not capable of harmonising their subconscious and conscious opinions.

On the other hand, in the female judges, there was no agreement at all between the two ratings; 0.50975, with a significant increase in ratings for most of the photographs and 80% of them mentioned that the knowledge of the term would affect their judgment. Hence, the female judges showed more reliability in their answers and were both consciously and subconsciously sure of their judgment.

The frequency and percentage calculations of the smile aspects, chosen in the questionnaire, that were supposed to affect the smile attractiveness rating; showed no statistically significant difference. This denoted that the esthetic judgment was based on multiple factors combined together. That was in contrast to the findings of Lukez et al [23] in which the esthetic judgment was mainly based on malposition of teeth.

The results of this study showed that laymen lacked all knowledge of the buccal corridor and that it didn't affect their judgment at all, initially. The introduced knowledge affected laymen's further judgment positively with no discrimination among the different sizes of buccal corridors. Female judges showed more reliability in their opinions than male judges.

In conclusion, laymen build their esthetic judgments on what we teach them, and modifying treatment plans to include corrections of buccal

corridors for esthetic reasons only is a myth.

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