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Are buccal corridors and smile width relating to smile esthetics? - A Photometric Study

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ABSTRACT

Background: The present photometric study investigated the correlation of buccal corridor and smile width to an esthetic smile and the influence of the facial form on it.
Materials and Methods: Standardized photographs of posed smile of 60 subjects in the age range of 17-25 years were taken. Among those 60 subjects, 3 groups were divided as 20 subjects each in leptoprosopic facial form, mesoprosopic facial form and euryprosopic facial form (according to morphological facial index given by Martin and Saller in 1957). Frontal smile photographs were taken and measurements of maximum smile width, right and left buccal corridor spaces were done according to methodology proposed by Johnson and Smith (1995) using software Corel DRAW X7.
Results : As separate evaluation done by orthodontists and lay persons and both of them presented with no differences of buccal corridor width and the total smile width in the esthetic smiles from comparing the percentage between the study groups.
Conclusion Remarkable finding was that the buccal corridor width and total smile width does not alter with the 3 types of facial form and broad faces have a tendency for broader buccal corridor and narrow faces have smaller buccal corridor.

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1. Introduction

Modern orthodontic treatment objective works to bring an attractive and a well-balanced smile. Several features like presence of smile arc, amount of gingival display, shade of teeth etc. influencing the smile esthetics in orthodontic therapy. In addition to these a potentially significant feature which can influence the smile esthetics is the buccal corridor space which was first introduced by Frush and Fisher (1956) as the bilateral space available between the buccal surface of the utmost evident and can be seen clearly maxillary posterior teeth and the lip commissure while smiling. [1,2]

As reported by Hulsey (1970), enchantment of the smile is little affected by the buccal corridor ratio. [3] Sarver and Ackerman (2003) suggested that to improve smile esthetics we should expand the narrow arch forms that further reduces the buccal corridor. [4] As stated by Morre (2006), minimal buccal corridors is a pre- requisite among orthodontists and laypersons to bring smile esthetics. [5] While according to Burstone (2007) the concept of buccal corridor is not of any clinical significance and does not recommend the expansion of narrow arches to decrease the buccal corridor. [6]

Based on the aforementioned controversies and lack of supporting evidence concerning the importance of buccal corridor space in orthodontic treatment, the prime aim of present study was to ascertain the percentage or proportion of buccal corridor towards the esthetics of smile. Also,

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according to various researchers, a leptoprosopic individual has a narrow arch form and an euryprosopic individual have a broad arch form. So ideally, buccal corridor width should be more in leptoprosopic individual and less in euryprosopic individuals, but this is not the case as reported by Sabri and Rigsbee.[7,8] Therefore, overall effect of facial form on buccal corridor width is the other objective of the present study.

2. Materials and Methods

Frontal smile photographs were taken and measurements of maximum smile width, right and left buccal corridor spaces were done according to methodology proposed by Johnson and Smith (1995) using software COREL DRAW X7. In the present study standardized photographs of posed smile was taken of 60 subjects (30 males; 30 females) which were in the age range of 17-25 years. Among those 60 subjects 3 groups were divided as 20 subjects each in leptoprosopic facial form, mesoprosopic facial form and euryprosopic facial form (Table 1). Only the subjects who were having complete permanent dentition (3rd molars were excluded), fine alignment of teeth in both upper and lower arches with slight exception of minimum crowding/ negligible rotations which is not evident while smiling, no previous history of orthodontic treatment, and a equity among the facial thirds with a voluntary lip seal.

Table 1: Percentage of Buccal Corridor width with total Smile width

Facial form	Total buccal corridor (%)
Mesoprosopic (N=20)	8.00%
Euryprosopic(N=20)	9.55%
Leptoprosopic (N=20)	7.26%

2.1. Determination of the facial form

The study groups faces were classified accoding to morphologic facial index given by Martin and Saller (1957).[9] For each subject, the morphologic facial index was determined by dividing the morphologic facial height by the bizygomatic width and according to morphologic facial index, subjects were divided as

Euryprosopic 79.0 -83.9
Mesoprosopic 84.0 -87.9
Leptoprosopic 88.0 -92.9

2.2. Determination of the smile width and buccal corridor width

A standardized black and white photograph of lower facial one- third including the nose tip and chin was taken of study groups with posing frontal smile and sitting in comfortable posture with head in upright position. Standard protocol was followed for taking all the photographs that means in same environment under similar conditions using CANON 1300D camera. The distance from the subject to the camera remained constant, specifications were 90mm macro lens, focal length- 20 centimeters, aperture size-F-32, shutter speed- 1/15, resolution- 18 mega pixel, compression format-JPEG, camera height was variable as depending on the subject's height.

All the measurements of the frontal smile photographs were calculated according to the methodology given by Johnson & Smith (1995) using software Corel DRAW X7 (Figure 1). On the basis of the smile width (SW), right and left buccal corridor spaces, percentage of combined right and left buccal corridor spaces with the SW during smile was determined.

Fig. 1: rontal smile photograph using Corel DRAW X7 software

Black and white prints of smile photographs were taken and assembled in an album which was given to five orthodontists and five lay persons for esthetic evaluation. The esthetic evaluation was done using VISUAL ANALOG SCALE (VAS) attached below each photograph. The VAS value varies progressively from esthetically very bad, bad, average and good to very good. (Figure 2)

Fig. 2: VAS used for recording the smile esthetics

Each examiner was asked to mark on the VAS a point on which the smile was closest to the corresponding value of the VAS. After each examiner completed the esthetic evaluations, the points marked on the VAS were converted into grades from 2 to 10, 2 being the minimum esthetic value and 10 the maximum esthetic value. In each category of evaluators (say orthodontists), mean of esthetic scores was determined for each photograph. Those photographs which received a mean esthetic score of 5 (corresponding

to average) and above were considered as esthetic and were further selected for statistical analysis.

All the results were statistically evaluated using student t test, one way analysis of variance, Tukeys test and a level of significance (P value) was set at 0.05 to be statistically significant.

3. Results

Out of a total of 60 smiles, 46 and 39 were esthetic according to orthodontists and any lay persons respectively. Results were evaluated and tabulated in following tables.

Table 2: Percentage of Buccal Corridor width with total Smile width as evaluated by orthodontists in esthetic smiles

Facial form	Total buccal corridor (%)
Mesoprosopic (N=14)	8.34 %
Euryprosopic (N=15)	8.33%
Leptoprosopic (N=17)	7.27%

Table 3: Percentage of Buccal Corridor width with total Smile width in esthetic smile as evaluated by Laypersons

Facial form	Total buccal corridor (%)
Mesoprosopic (N=15)	8.55 %
Euryprosopic (N=10)	9.01 %
Leptoprosopic (N=14)	7.24%

Table 4: Comparison of means of % of Buccal Corridor with Total Smile width in three different facial forms.

Facial form	Buccal corridor (mean ± sd)	ANOVA Test (P Value)
Mesoprosopic (N=20)	8.00 ± 3.00	0.0473
Euryprosopic (N=20)	9.55 ± 3.04	
Leptoprosopic(N=20)	7.26 ± 2.69	

There was statistically significant difference between the means of the percentage of the buccal corridor width with the total smile width of 20 leptoprosopic, 20 mesoprosopic and 20 euryprosopic individuals (P= 0.0473) which is less than 0.05. Hence, for all possible pairwise comparison, Tukeys test was used as shown in Table 5.

Table 5: Pairwise comparisons among the three different facial forms

Tukey's Multiple Comparison Test	P Value
Mesoprosopic vs euryprosopic	0.221
Mesoprosopic vs leptoprosopic	0.702
Euryprosopic vs leptoprosopic	0.041 (p<0.05)

Table 6 Comparison of means of percentage ofbuccal corridor and total smile width in esthetic smiles, of leptoprosopic, euryprosopic and mesoprosopic individuals, as evaluated by each category of evaluators

Table 6: According to Orthodontists

Facial Form	Buccal Corridor (Mean ± SD)	ANOVA Test (P Value)
Mesoprosopic (N=14)	8.34 ± 3.22	
Euryprosopic (N=15)	8.33 ± 2.27	0.4786
Leptoprosopic (N=17)	7.27 ± 2.84	

Table 7:

Tukey's Multiple Comparison Test	P value
Mesoprosopic vs Euryprosopic	0.221
Mesoprosopic vs Leptoprosopic	0.702
Euryprosopic vs Leptoprosopic	0.041 (p<0.05)

Table 8: According to Lay Persons

Facial Form	Buccal Corridor (Mean ± SD)	ANOVA Test (P Value)
Mesoprosopic (N=15)	8.55 ± 3.01	
Euryprosopic (N=10)	9.01 ± 3.25	0.3497
Leptoprosopic (N=14)	7.24 ± 3.10	

Table 9:

Tukey's Multiple Comparison Test	P Value
Mesoprosopic vs Euryprosopic	0.933
Mesoprosopic vs Leptoprosopic	0.505
Euryprosopic vs Leptoprosopic	0.372

There was no statistically significant difference between the means of percentage of buccal corridor and total smile width in esthetic smiles, of leptoprosopic, mesoprosopic and euryprosopic individuals as evaluated by the orthodontist (P= 0.4786) and layman (P= 0.3497)

4. Discussion

The mean percentage of the buccal corridor width with the total smile width for the sample selected in this study was found out to be 8.27%. This value is in accordance with the values found out by Johnson and Smith (1995). [10] According to their study the mean percentage of the buccal corridor width with the total smile width was found out to be 9%. The similar results between the results of present study and the findings of Johnson and Smith can be attributed to use a camera with a ring flash to take the smile photographs. In our study also, a camera with the ring flash was used. [10]

The mean value of the percentage of the buccal corridor with the total smile width as found out by Rigsbee et al

(1988) was 40% in an orthodontically treated group and 42% in a non orthodontically treated group.[8] The large difference between the results of present study and the findings of Rigsbee can be attributed to the fact that these authors measured the buccal corridor by Hulsey's method considering the distance between the maxillary canines as the lateral limit of the maxillary arch.[3] This is not the buccal corridor in true sense as explained by Frush and Fisher.[2] This is also supported by Valiathan (2005)[11] that generally, a smile includes not only the six anterior teeth but also the first premolars. Henceforth, posterior teeth should be included when evaluating buccal corridor space.

As predicted in our study that there was no statistically significant difference between the overall means of percentage of buccal corridor width and total smile width in esthetic smiles which was evaluated by each evaluator of both types. This signify that the esthetic smiles might have been judged to be "esthetic" (by the orthodontists and lay persons) on the basis of alternative criteria like the lip line, the smile line, smile symmetry, upper lip curvature, dental and the gingival components. From this remarkable finding, here we can conclude that in a normal population, the width of the buccal corridor does not play a significant role in smile esthetics.

Our statement is in agreement with the conclusions of Frush and Fisher (1958) and Johnson and Smith (1995).[2,10] These authors agree that the size of the buccal corridor is not esthetically critical.

In contrast with our study, Moore et al (2005)[5] found that lay persons were able to discriminate between the degrees of smile fullness and that they preferred smiles which were visibly filled with the dentition. This difference can be explained by two facts- firstly, they stated that the size of buccal corridors influences smile attractiveness when the entire face is taken in context and secondly, in their study, sample from a normal population was not evaluated. Instead one smile was digitally altered to produce a wide range of variation in the width of the buccal corridor (28% buccal corridor in a narrow smile to 2% buccal corridor in a broad smile). Such wide range of variation was significant enough to produce a noticeable effect on smile esthetics. When digital alteration of the smile photographs was not done to extremes, as in case of study done by Roden-Johnson et al (2005),[12] it did not affect the ratings of the smile as evaluated by the general dentists and lay persons (threshold for human perception of excessively wide buccal corridors was not met). The present study is in accordance with the above mentioned study.

Out of the total smiles judged to be the most esthetic by the orthodontists (N=46), the mean of the percentage of the buccal corridor width with the total smile width, for 17 leptoprosopic subjects was found to be 7.27%, for 14 mesoprosopic subjects was 8.34% and for 15 euryprosopic subjects was 8.33% There is no statistically significant difference between the means of percentage of buccal corridor and total smile width in esthetic smiles, of leptoprosopic, mesoprosopic and euryprosopic individuals as evaluated by the orthodontists. Also these means are similar to the overall mean of the group. This means that buccal corridor percentage doesn't changes with the facial form according to orthodontists, which again supports our earlier assumption that dental arch develops in line with the facial form such that the width of face, dental arches and buccal corridor becomes proportional to each other.

5. Conclusion

As determined by the orthodontists and lay persons, there is no difference in the percentage of buccal corridor width and the total smile width in attaining the esthetic smiles as these both are similar in "esthetic smiles" group as well as in "normal population" group (≈8% according to present study).

Therefore we conclude in our present photometric study the width of the buccal corridor does not play a significant role in smile esthetics. Another remarkable finding was that the percentage of the buccal corridor width and the total smile width does not alter with the facial form in general.

6. Source of Funding

None.

7. Conflict of Interest

None.

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