Original Article

Smile arc Preference in Various Facial Proportions

Nabila Anwar, Rizwan Shah and Hassan Naveed

ABSTRACT

Objective: To elucidate the effect of alteration of smile arcs on attractiveness of the smile and to find the most attractive smile arc for a particular face type.

Study Design: Cross sectional analytic study.

Place and Duration of Study: This study was conducted at Rehmat Memorial Post-graduate Teaching Hospital (Women Medical and Dental College, Abbottabad for a period of June 2017 to February 2018.

Materials and Methods: Photographs of two selected male and female subjects were altered to produce three face types for each individual. Smile arc was then altered in the produced facial types. The pictures were then rated for attractiveness by different professionals.

Results: The total number of raters was 100 with the mean age of 30.3 years ± 8 years. The alterations in the smile arc produced statistically significant difference in the attractiveness of faces whereas the perception difference was found to be insignificant amongst raters of different professions. Consonant smile arc was preferred in all subjects except for brachyfacial subjects where a flat smile arc was preferred.

Conclusion: The variability in various smile arcs showed significant difference in the esthetic score. Preferred smile arc was found for individual face types.

Key Words: Face types, Smile arc, Facial esthetics

INTRODUCTION

Facial esthetics and appearance have attained a pivotal role in personal, professional and social life of individuals in the modern era.[1,2] In the light of modern orthodontics, soft tissue paradigm in clinical orthodontics has made smile analysis and designing, key elements in treatment planning. Orthodontists are involved in treatment which can alter a patient's facial appearance and particularly a patient's 'smile'. Orthodontists are accustomed to patients who often complain of their inability to smile due to their unattractive appearance of teeth and this ultimately becomes a social disability. This situation becomes the prime reason for patients to seek orthodontic treatment in view of correcting their social handicap.[3]

Smile has been described as posed smile and spontaneous smile by Ackerman et al, a concept based on the studies of facial expressions.[4]

Smile is an integral constituent of the facial attractiveness of a person.[5,6]

Department of Orthodontics, Women Medical & Dental College, Abbottabad.

Correspondence: Nabila Anwar, Associate Professor, Department of Orthodontics, Rehmat Memorial Dental Hospital, Abbottabad.
Contact No: 0300-5564464
Email: drnabilaanwar@gmail.com

It is a sum of many attributes amongst which smile arc is one of the most important constituent. Smile arc, by subjective definition is a virtual line that connects the incisal edges of the maxillary anterior teeth that commonly follows the upper border of the lower lip. The ideal relationship on smiling is considered to be parallel and is known as a consonant smile.[7] If the two are not parallel (with flatter maxillary incisal curvature to the upper border of lower lip), it is called a non-consonant smile.[7] Average and parallel smile lines are most common and are mainly influenced by the age and gender of a person along with other factors like orthodontic treatment, inherent growth pattern, attrition etc.[8]

In the current orthodontic era, the orthodontists aim to treat the face in 3 dimensions i.e. the vertical, sagittal and transverse dimensions. Each dimension has its own importance and hence needs to be considered thoroughly while sorting a viable treatment plan for the patients. These facial dimensions also have an influence on the smile design of the individuals. Hence the teeth have to exist in a balanced environment with the facial dimensions in order to produce acceptable esthetics. In vertical dimension, the face has been divided in to three subjective facial types which are the long- face (dolichofacial), short- face (brachyfacial) and normal face (mesofacial).[9]

In clinical practice, faces with various facial proportions are encountered having smile problems. Literature reveals that vertical proportions have not been studied thoroughly while considering the smile architecture.[1-4,6-8] Our aim was to clarify the effect of

alteration of different smile arcs on attractiveness, to find out the most attractive smile arc for a particular face type and to determine any difference in perception of esthetics amongst people belonging to different professions.

MATERIALS AND METHODS

This cross sectional analytical study was done at the Rehmat Memorial Post-graduate Teaching Hospital. After taking the informed consent, various subjects were selected for posed frontal smiling photographs. One male and one female subject was finalized on the basis of optimal harmony and symmetry in their face and smile. A new set of different frontal posed smiling pictures were taken for the two selected subjects to capture the best frontal smiling photograph. The photographs were then altered using adobe photoshop version 8.0 (Adobe Systems, San Joe, CA, USA) with some professional help in this regard. The pictures were first altered to make three face types for the same subject by altering the facial height to width ratios as shown in Figure 1. Smile arc was then altered for various facial proportions as shown in Figure 2.

Smile arc was changed as consonant, flat and reverse types. The modified images were imported into Microsoft Power Point (Microsoft, Redmond, WA, USA) as a presentation in a predetermined order for evaluation by 100 judges belonging to 4 groups including orthodontists, restorative dentists, arts and fashion designers and laypeople. A five point visual analogue scale with an interval of a whole number on a data collection form was used to rate the provided images, projected for a set number of seconds in order to standardize the rating of every picture for each rater.

RESULTS

The total number of raters was 100 amongst them 25 were orthodontists, 25 were restorative dentists, 25 were arts and fashion designers and 25 were laypeople. The mean age of the raters was 30.3 years ± 8 years. Results of ANOVA showed that there was no statistical difference in age amongst all the groups (p= 0.20). Result of Chi square showed equal gender distribution in all groups with p-value of 0.23. Table I shows the results of multiple factor ANOVA for altered smile arcs.

Table No.I: Result of Repeated Measure ANOVA for Smile Consonance

Variable		Gender	Face Type		
			Dolicofacial p-value	Mesofacial p-value	Brachyfacial p-value
Smile Consonance	Factor	Male	0.05*	0.04*	0.03*
		Female	0.05*	0.02*	0.01**
	Factor & Category	Male	0.1	0.69	0.32
		Female	0.9	0.6	0.21

* *P*=.05; ** *P*=.01; *** *P*=.001

Table No.2: Mean Scores for Smile arc Preferences in the Three Face Types

Smile ARC	category	Dolichofacial Male		Mesofacial Male		Brachyfacial Male		Dolichofacial Female		Mesofacial Female		Brachyfacial Female	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
consonant smile	orthodontist	3.80	1.0	4.20	1.0	3.80	0.8	4.25	1.1	4.00	0.7	4.10	0.8
	restorative dentist	4.20	1.1	4.10	0.9	4.00	1.3	4.30	1.4	4.20	0.8	3.80	1.2
	arts and fashion	3.89	1.1	3.80	1.0	4.20	1.0	4.20	1.0	4.10	0.8	3.90	0.9
	lay person	4.20	1.0	4.50	0.8	3.70	1.0	4.00	1.3	4.09	1.0	3.90	1.1
	Total	4.00	1.1	4.20	0.9	4.00	1.1	4.20	1.2	4.10	0.9	3.90	1.0
flat smile	orthodontist	2.92	1.0	3.00	1.0	4.20	0.9	3.50	0.9	3.80	1.1	4.20	1.0
	restorative dentist	2.20	1.1	3.08	1.1	4.00	1.3	3.80	1.0	4.00	0.6	4.00	1.0
	arts and fashion	2.40	1.0	3.00	0.9	4.30	1.1	3.90	1.3	3.90	0.9	4.50	1.0
	lay person	2.45	1.0	3.64	1.0	4.50	1.0	4.00	0.9	4.10	1.3	4.30	1.0
	Total	2.60	1.0	3.16	1.0	4.20	1.1	3.80	1.1	3.90	1.0	4.30	1.0
reverse smile	orthodontist	1.50	0.7	1.40	1.0	2.33	0.8	2.17	0.7	2.83	0.9	2.92	0.8
	restorative dentist	2.08	1.1	2.00	0.9	2.54	1.1	2.54	1.3	2.85	0.8	2.31	0.9
	arts and fashion	1.07	1.3	1.36	0.7	3.00	1.0	2.14	1.2	2.70	0.8	3.07	1.0
	lay person	2.00	1.1	1.90	1.3	3.18	1.3	2.82	1.1	2.90	1.6	3.18	1.1
	Total	1.60	1.1	1.70	1.0	2.76	1.1	2.4	1.1	2.80	1.1	2.86	1.0

Figure No.1: Different Face Types for the Female and Male Subjects
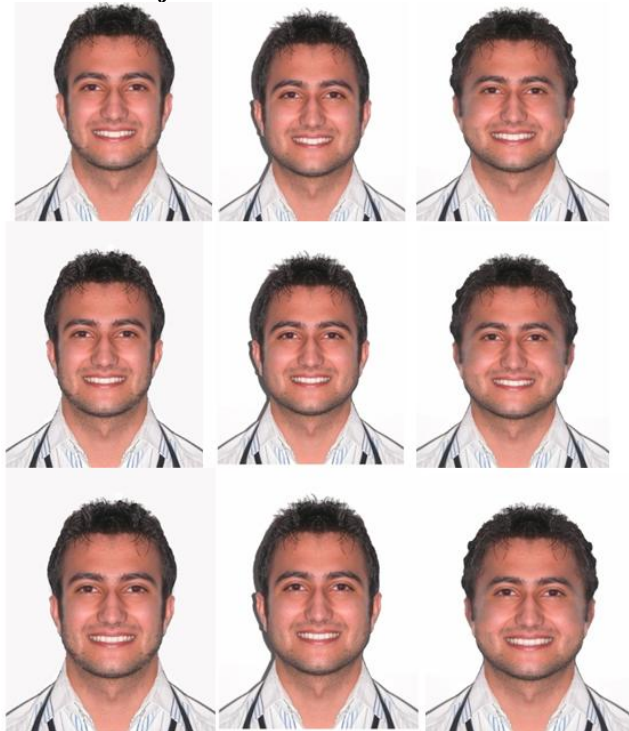

Figure No.2: Frontal face showing smile arc variations for various facial proportions

The factor denotes the variability in the parameter chosen whereas the category denotes the raters belonging to different professions in order to note any possible difference in the perception of esthetics. When the category and the factors are taken together there is statistically insignificant difference in the perception of esthetics for the altered parameters in all the three face types which shows insignificant difference in perception of esthetics amongst the different professionals. However, when only factor is considered, the alterations in smile arc resulted in statistically significant difference in the perceived attractiveness of the face. Table II shows the mean scores for various

smile arc preferences. Smile consonance was preferred for all face types in both genders except in brachyfacial subjects where flat smile arc was preferred.

DISCUSSION

Recognition of the smile characteristics for variant facial types is of vital importance for the orthodontists in this era of information where all sorts of knowledge and information is accessible to the patients on the internet. Not only the treatment should be aimed at achieving the consonant smile arc but due importance need to be given to the facial vertical types as well. Various researches show that the consonant smile arc is attractive when compared to a non-consonant smile arc but its relevance to the specific facial types has not been established. [7,10,11] Moreover, the evaluation of smile parameters separate from the facial features has been studied by various authors. [3,7,12-15] Our research was hence aimed at developing a broader understanding of the impact of specific face types on the smile arc and to establish current concepts of smile arc preferences according to the face type.

Smile perception is a highly varied entity and defining an ideal smile is a difficult task. Various smile attributes have been widely studied to define the ideal smile esthetics.[1-3] Thus an attempt was made to define smile perception among various groups of individuals in our research. The contribution of various raters from different professions in search for the ultimate attractive smile for a particular face type was the rationale of the current study. The diversity amongst various groups of individuals was taken in to consideration so as to determine the preferred smile arcs for various facial patterns. The technique used in our research of alteration of the same face into three face types freed the raters from the concern of other confounding features of the face. The ratings have enabled the formulation of some guidelines in designing an attractive smile for a particular face type.

Our study involved 100 raters, 25 from each group of different professions and laymen who rated 3 variations of smile arcs on 3 variations of face types. The 3 types of smile arcs included consonant, flat and reverse smile arcs. The 3 distinctive facial types were defined according to the vertical height of the face i.e. brachyfacial which is broader face type. The mesofacial face type in which the height and width ratio of the face are rather proportional resulting in a normodivergent facial pattern, and the dolichofacial type in which there an increased anterior facial height.[9] Smile esthetics have been widely studied in terms of smile arc effecting the esthetic attractiveness[16-22] but have seldomly corelated with vertical facial patterns. Our research thus aimed to define the interaction and the influence of smile arc on various vertical facial patterns.

AlShahrani [23] considered smile arcs among various undergraduate professional students involving the

medical, dental and IT departments. They concluded that all students were able to identify the consonant smile arc as being more beautiful than the flat and reverse smile arcs. Ker et al., Badran et al. and Parekh et al. also indicated similar results claiming that flat and reverse smile arcs have a negative effect on laypeople's perception.[19-21] Parekh et al. [24] further stated that less attractive smiles have excessive buccal corridors and flat smile arcs. Additionally, flat smile arcs appear to decrease attractiveness ratings regardless of the buccal corridors. This is in agreement with our study findings indicating that reverse and flat smile arcs were the least preferred among all the groups for all facial types except the brachyfacial face type for which the flat smile arc was chosen as the preferred one. A flat smile arc according to the author might add harmony to the brachyfacial face profile and therefore look more attractive than the consonant smile arc. It is interesting to note at this point that the vertical facial patterns can have an effect on the smile dimensions and can affect the smile preferences as well.

Smile arc should also be considered in treatment planning and bracket positioning when executing comprehensive orthodontic treatment for the patients. As indicated by Krishnan et al.[7] and Wong et al.[25] orthodontist's lack of consideration of the smile arc in treatment planning and mechanics can result in flattening of the smile arc and consequently less esthetic smiles. In this regard, consideration should be given to ideal smile arcs for specific types of face which is addressed in our study. Insufficient literature is available to relate smile arc with various vertical facial types and further research is required in this regard in order to determine the ideal smile esthetics for specific facial types in vertical plane of space.

Our study indicated that smile perception difference among various studied groups was almost similar as indicated by the multiple factor ANOVA. Similar results were indicated by various other studies [13,14,20,21] which compared the perception of laypeople, orthodontists and various other professions. Krishnan et al[7] analyzed the perception difference between lay persons and dental specialists and found no difference in perception between lay persons and specialists on the smile evaluation. No differences were found between the perception of male and female raters. This is consistent with the findings of Moore et al.[10], Ker et al.[19] and Martin et al.[26]

The end treatment smile should be planned to address both the patient's need as well as the perception. Not all face types suit the same smile perspectives and so individual face types need to be given their due importance when considering the smile design for individual patients.

CONCLUSION

The variability in smile arcs showed significant difference in the esthetic score; however, statistically insignificant differences were found in the perception

between raters of various professions. Consonant smile arc was preferred in dolichofacial and mesofacial face types in both male and female subjects. In brachyfacial subjects however, a flat smile arc was chosen as more attractive feature.

Author's Contribution:

Concept & Design of Study:	Nabila Anwar
Drafting:	Rizwan Shah
Data Analysis:	Rizwan Shah, Hassan Naveed
Revisiting Critically:	Nabila Anwar
Final Approval of version:	Nabila Anwar

Conflict of Interest: The study has no conflict of interest to declare by any author.

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