

Comparative Evaluation of Smile Arc in Population of Central India

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Abstract: Dentofacial appearance is the major determinant of over all physical attractiveness. Smile attractiveness includes a number of important components. Smile Arc includes the relationship of curvature of incisal edges of maxillary incisors and canines to curvatures of lower lip in posed smile. An ideal smile arc has maxillary incisal edges parallel to curvature of lower lip. This study carried out comparative analysis of different age group with smile arc and tooth arc for maxillary anteriors esthetics. 150 dentate patients of 3 groups (50 each) of different age groups were selected . Photographs taken with a digital camera showing the subjects with a posed smile were used for this study. Adobe photoshop and Math GV FREEWARE Version 4.1 parabolas used to determine the best fit for tooth and lip arcs. There were statistically significant differences due to ethnicity and gender. Mean lip arc had greater curvature than mean tooth arc.

Keywords: Math GV FREEWARE Version 4.1 parabolas.

I. Introduction

Dental professionals routinely have a significant role in the creation or restoration of a beautiful smile for their patients(3). However , smile dynamics are complex and multiple factors must be considered when objectively evaluating a patient's smile. A smile can have different cultures and social environments. According to Hulsey, " Smile is one of the most effective means by which people convey their emotions". (4)

Cosmetic means to do "something superficial to cover a defect or deficiency " and secondarily " serving to beautify the body". Tjan et al(2009) proposed a standard of normalcy in an esthetic smile relative to 4 factors.

Table 1.	
1.	Smile type (High , Average, or low)
2.	Parallelism of maxillary incisal curve with lower lip (Parallel , straight or reverse)
3.	Position of incisal curve relative to contact with lower lip (Touching , Not Touching, or slightly covered by lower lip)
4.	Number of teeth visually displayed in smile.

Smile variables evaluated by springer et al .(2005)

Table 2.	
1.	Smile arc
2.	Buccal corridor fill
3.	Maxillary gingival display and midline relative to face
4.	Vertical overlap of anterior teeth
5.	Gingival margin discrepancy in central incisor region
6.	Incisal edge discrepancy
7.	Mesiodistal cant of occlusal plane

Human esthetics implies a sense of beauty , a pleasing impulse , naturalness, and a youthful appearance relative to one's age. The goal for esthetic treatment should be an enhanced smile but natural appearance that imparts a vibrant and believable appearance to the patient (9) .Smile design should involve the evaluation of certain elements in a specific sequence: Facial analysis, Dentofacial analysis, dentolabial analysis , dentogingival analysis and dental analysis. It is critical to understand the esthetics is not a finite point ; in fact esthetics can be a broad zone. (10).

II. Material And Methods

150 subjects were selected in Department of Prosthodontics , Sharad Pawar Dental College ,Sawangi (Meghe) Wardha, in which three groups were divided. 50 subjects in one each group were selected as per age.

Group A(50 subjects)- 17-24 years

Group B (50 subjects)- 25-32 years

Group C (50 subjects)- 33-40 years

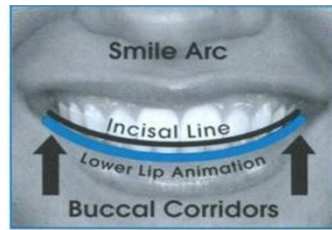
Inclusion Criteria :

1. All subjects over 17 years of age
2. All subjects with class1 ,class2 division1 , class2 division2 and class3 malocclusion.
3. All subject without a history of plastic surgery to the lips
4. All subjects with anterior teeth present.

Armamentarium

Following armamentarium were used in this cross- sectional study.

1. Digital camera
2. Math GV FREEWARE Version 4.1
3. Adobe photoshop
4. Different color coded line generated by Math GV FREEWARE VERSION 4.1



Method

Class photographs were used for this study. These photographs were taken with a digital camera and showed the subjects with relax and posed smile. From a larger number of available pictures , images were selected that fully displayed the maxillary anterior incisal edges and in which the subject was facing directly toward the camera.(fig1).

Curves were generated with Math GV FREEWARE Version 4.1 as parabolas of the formula $f(x)= nx^2$ (fig 3), Where n ranged from 0.025 to 0.350 in increments of 0.025. The curves were rendered as semitransparent overlays, which were manipulated over the images using Adobe photoshop to determine the best fit for tooth and lip arc.(fig 4)



Fig 1 . Relaxed and posed smile

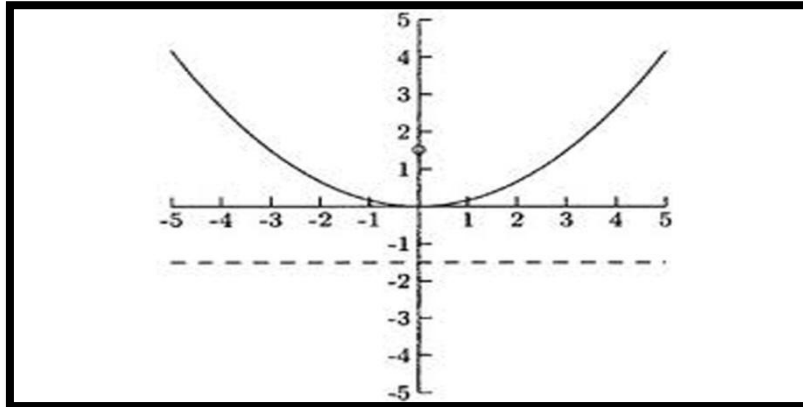


fig 3. Parabolas with formula $f(x) = nx^2$

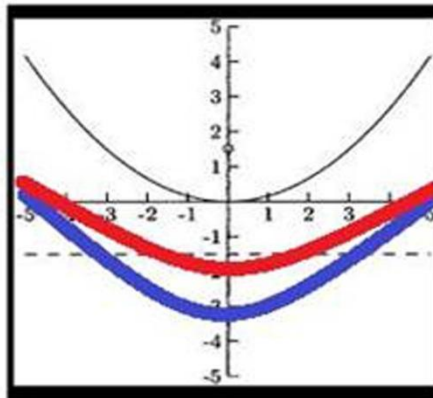


Fig 4. Parabolas with two different color coded line generated to measure distance

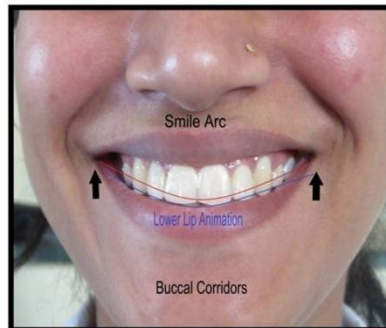


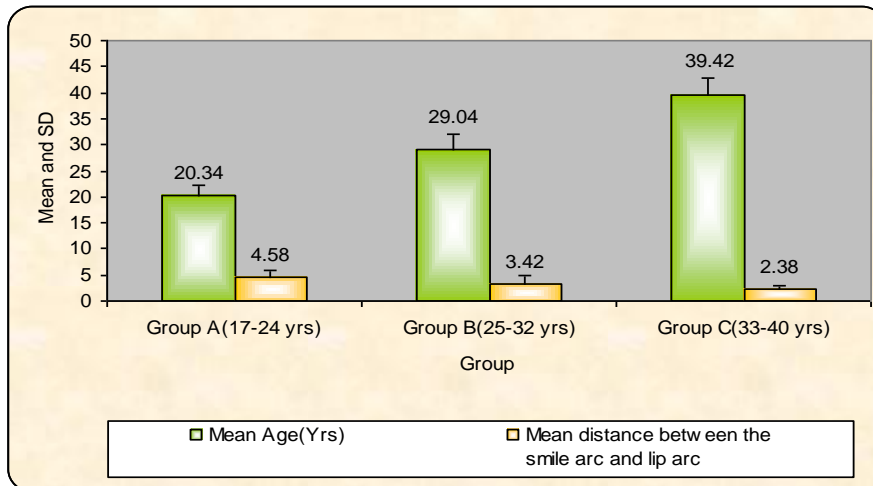
Fig : 4 Math GV FREEWARE Version 4.1

III. Results

Mean tooth arc and lip arc in different age groups were $f(x) = 0.084x^2$. Factorial one way ANOVA for tooth arc and lip arc revealed a statistically significant interaction. The multiple comparisons : Tukey HSD test revealed that tooth arc and lip arc in significantly greater in group A to group c . ($p < .001$).

Multiple Comparisons : Tukey HSD

Group		Mean Difference (I-J)	Std. Error	p-value	95% Confidence Interval	
					Lower Bound	Upper Bound
Group A	Group B	1.16	0.25	0.000 S.p<0.05	0.57	1.76
	Group C	2.20	0.25	0.000 S.p<0.05	1.60	2.79
Group B	Group C	1.03	0.25	0.000 S.p<0.05	0.43	1.62



Mean tooth arc and lip arc exposure in group A (17- 24 Years) mean age is 20 years – 4.58 ,group B (25- 32Years) mean age is 29 years – 3.42 , and group C (33- 40 Years) mean age 39 years – 2.38 .

IV. Discussion

Atrophy of muscles result in decreased lip volume , loss of lip architecture, and lip lengthening(5). The decrease in upper lip thickness quantified the empirical observations of thinning lips by researchers and practitioners. Increase in intercommisural width could be due to loss of skin elasticity and volume which increased the wrinkles at the corners of the lips. Maxillary incisors display was decreasing with age due to increase in lip length and also somewhat with attrition of teeth. Smile index had increased because intercommisural width had increased with age and interlabial gap had decreased with age. The aging smile gets wider transversely and narrower vertically. With advancing age ,there was a decrease in the muscles ability to raise the upper lip. The upper and lower lip frame the display zone of the smile. The soft tissue determines of the display zone are lip thickness, intercommisure width, interlabial gap , smile index (width/ height) and gingival architecture.(5).

Social smile is typically used as a greeting , voluntary , unstrained , static facial expression. Monalisa smile is characterized by the action of zygomaticus major muscles, drawing the outer commisures outward and upward, followed by a gradual elevation of the upper lip (8).There are other softwares also applied to analysis smile like EDIUS5.0 SOFTWARE , ADIURS 6.0 SOFTWARE etc.

Application of smile designing by applying Math GV FREEWARE version 4.1 are as follows:

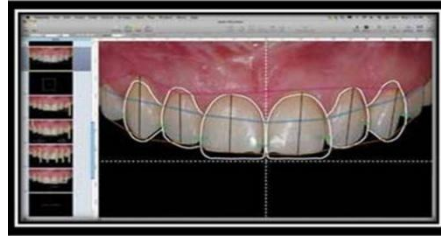
1. The facial photograph with a wide smile



2. Transferring the cross to the smile



3. Lines can be added as needed to help visualize the esthetic issues



4. Measuring the length of the central incisors



• According to Akermen & Profit(2009)

Tooth exposure according to gender appeared to be significantly more important for females than of males .

- Average exposure (Males)- 1.91 mm
- Average exposure (Females)- 3.40 mm
- Average exposure of mandibular incisor – 0.5 mm

• According to Ronald Goldstein(Lip length and tooth exposure)

Lip length(mm)	Exposure of maxillary incisor(mm)	Exposure of mandibular incisor(mm)
10-15	3.92	0.64
16- 18	3.44	0.77
21-25	2.18	0.98
26-30	0.93	1.95
31-36	0.25	2.25

V. Conclusion

Within the limitation of present study, the following conclusions were drawn :

1. As in age advance the maxillary incisors exposure is decreased .
2. Due to ageing , tooth exposure is decreased by 1.5 mm as concluded in this present study.
3. As there is no ideal smile . the most esthetic objective must be to achieve a balanced smile by adequate positioning of teeth within themselves and within gingival and soft tissues.
4. Smile analysis and smile design generally involved a compromise between two factors : esthetic desires of the patient and patient’s anatomy and physiology.

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