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ORIGINAL ARTICALE

DENTO-GINGIVAL SMILE ANALYSIS ON YOUNG ADULTS OF SOUTH CHENNAI: A CROSS-SECTIONAL STUDY

G S V Nivashini[1], Janani Balachandran[2], Mitthra Suresh[3], Alagarsamy Venkatesh[4] , Pooraninagalakshmi J[5] , Jinu Merlin Koshy[6],

[1]**MDS, Senior Lecturer** Dept of Conservative dentistry and Endodontics, CSI College of Dental Sciences & Research, The Christian Mission Hospital Compound, E Veli St, Madurai- 625001 Tamilnadu State, India,Email id : drnivashini.endo@gmail.com

[2]**MDS, Reader, (Corresponding author)** Dept of Conservative dentistry and Endodontics, Sree Balaji Dental College & Hospital, Bharath Institute of Higher Education and Research (BIHER), Pallikaranai, Chennai-600100, Tamilnadu State, India Email id janani.balachandran@gmail.com

[3]**MDS, Professor and Research Co-ordinator,** Dept of Conservative dentistry and Endodontics, SRM Kattankulathur Dental College & Hospital,SRM Institute of Science and Technology (SRMIST),Potheri, Kattankulathur, Chengalpattu- 603203 Tamilnadu State, India Email id: mitthras@srmist.edu.in

[4]**MDS, Professor & Head,** Dept of Conservative dentistry and Endodontics, Sree Balaji Dental College & Hospital, Bharath Institute of Higher Education and Research (BIHER), Pallikaranai, Chennai-600100, Tamilnadu State, India Email id- denvenkat@gmail.com

[5]Assistant Professor Department Of Conservative Dentistry And Endodontics Sree Balaji Dental College And Hospital Bharath Institute Of Higher Education And Research Email id - pooranijana@gmail.com

Associate Professor, Department of Anatomy Sree Balaji Medical College & Hospital, Bharath Institute of Higher Education and Research, Chennai. Email id -jinumerlinkoshy@gmail.com ORCID ID https://orcid.org/0000-0002-2072-6576

Corresponding authors: Dr. Janani Balachandran, M.D.S, Reader, Dept of Conservative dentistry and Endodontics, Sree Balaji Dental College & Hospital, Bharath Institute of Higher Education and Research (BIHER), Pallikaranai, Chennai-600100, Tamilnadu State, India. Mobile Number- +91-994100678; E-mail – janani.balachandran@gmail.com

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Abstract

Aim: This study aims to assess and analyse dento-gingival parameters in young adults residing in South Chennai. This study aims to assess and analyse dento-gingival parameters in young adults residing in South Chennai.

Materials and Methods: A cross-sectional study was carried out among 100 participants (61Females & 39 males) between 18 and 23 years, within South Chennai region. The dento-gingival parameters such as smile line, buccal corridors, midline shift, and parallelism were determined by evaluating the participants photographs through Adobe Photoshop. The data analysis was done using Spearman's correlation test and chi-square test for nonparametric data.

Results: Buccal corridors were not present in 52% of the young adult population. 48% of young adults found to have non-parallel smile. A high smile line was observed in 23% of the participants. Dental midline shift was found in around 30% of young adults. There was a statistically significant difference in the parallelism of the lower lip line and the incisal curve incisal curve as well as in the upper lip line position in both the genders ($P < 0.05$).

Conclusion: Understanding the dento-gingival unit as a whole and its association with the oral environment can help guide the clinicians in establishing an aesthetically pleasing treatment outcome.

Keywords: smile analysis, smile line, parallelism, midline shift, and buccal corridors.

INTRODUCTION

In the modern era, patients claim for a highly aesthetic treatment outcome. In that case, clinicians must conduct a full facial and dental evaluation to enhance smile, which will address the patient's concerns and inquires while objectively and consistently assessing the patient's smile and face [1]. The combination of facial and dental parameters is needed to design an aesthetically pleasing smile. Interrelationships between the lips, face, teeth and gingiva are macro-aesthetic components. Micro-aesthetics are the aesthetics of a single tooth, including its contour, colour, size and shape. Smile analysis considers the macro- and microelements of facial, dento-facial, and dental aesthetics [2]. A number of researches involving various

populations have shown that aesthetic components for people from different demographics are not entirely the same [3-7].

The incisal edges of the maxillary anterior teeth make an angle with the curvature of the upper lip, creating the smile arc. Their ideal smile relationship is referred to as a consonant smile, which is parallel to each other. A non-consonant smile occurs when the two are not parallel to each other (a flat maxillary incisal curvature) [8.] Ackermann et al used a computerised inter-discipilinary study to compare the features of smile-arc in patient with treatment and without treatment; they found flattened smile arc in 37% of the treated subjects and non-consonant smiles in only 5% of the untreated group [9].

Buccal corridors are the dark or negative spaces that occur between the corners of the lips and the facial surfaces of the posterior teeth [10]. According to Johnson and Smith's [11] investigation on the effect of premolar extraction on the visibility of negative space, there is no correlation between the extraction pattern and the visibility of negative space. According to a recent study, large buccal corridor spaces should be considered in the treatment regimen, whilst smaller buccal corridors can be left untreated [12].

Ackermann and Ackermann developed a smile index to describe the smile's display zone. By dividing the inter-labial space during smiling, the inter-commissural width may be calculated [13].

The study's null hypothesis is that young individuals in South Chennai do not vary in terms of demographics or smile characteristics. A cross-sectional research was conducted to evaluate the positioning of the smile line, the parallelism of the incisal line and lower lip line, the position of the arch midline, and the presence or absence of the buccal corridor. The results can be used as a guide for better smile planning and restoration procedures in the target populations.

MATERIALS AND METHODS

Sample size estimation:

The cross-sectional study was conducted within South Chennai. G power software version 3.9.1 was used to estimate the sample size.

Level of significance alpha = 0.05

Power Beta = 80%

Effect size d= 0.28

Total sample size = 97

Which can be rounded off to 100

This cross-sectional study was approved by the Institutional Ethical Committee of Sree Balaji Dental College & Hospital, Bharath Institute of Higher Education & Research (Approval number: SBDCH-IRB/22-06 /09). Signature was obtained in the informed consent from all 100 participants after explaining the purpose of the study. Young adults of South Chennai between 18 and 23 years were considered as the target study population. Participants from the non- demographic zones were excluded from the study. The exclusion criteria also included participants with bleached dentition, dental fluorosis, hypoplasia and also participants who had prosthodontic and orthodontic interventions [14,15].

Photography:

A standard photograph of each participant showed their full social smile (frontal smile) was captured, using Samsung galaxy note 10+ (version 10.5.01.6). Standardized settings of 1/15 second shutter speed, F1.5, and ISO 100 were set. The participant was positioned at a 90-degree angle with the tripod stand individually adjusted for each participant's height. The participant's nose was 25 cm away from the camera when the pictures were taken.

Smile analysis:

To determine the exact position of the upper lip line, a line was drawn parallel to the upper lip contour and gingival zenith of the top anterior teeth in reference to teeth 13 to 23. When the gingival zenith and upper lip line were seen to be 2-3 mm apart, it was deemed high with full teeth and gingival exposure. When 75-100% of the clinical crown height was noted, it was considered medium. The upper lip line was deemed low when the upper lip covered 25% or more of the labial surface of the upper front teeth.

Two curves were drawn, one following the incisal curve and one following the lower lip line to establish parallelism. A vertical line was drawn along the base of the philtrum to establish the facial midline and the other line drawn along the central incisors was used to assess the correlation between dental and facial midline. The discrepancy of the dental midline from the face midline was measured in pixels and then was converted to millimetres using a ruler tool. Using the latest version of Adobe Photoshop, the buccal corridor between the posterior teeth and the commissures was examined for its presence or absence (8.1.958).

Statistics:

For data analysis, Statistical Package for Social Sciences (SPSS, Version 25, IBM Corporation, Chicago, IL, USA) was utilised. A descriptive research was conducted on the buccal corridor's existence or absence, parallelism, midline displacement, and smile line.

Mann–Whitney *U*, independent *t* and Chi-square were used to analyse if there was a significant difference between both the genders. For all statistical analysis, $P = 0.05$.

RESULTS

Using SPSS V25, the collected data were organised in a structured manner. The data was transferred from a table that was made using Excel 2010. Analysis was done on the data from all 100 individuals (61 females and 39 men). Table 1 explains the distribution of smile parameters.

Smile line:

The dimensions of the smile lines of the female participants were distributed as follows: With a medium smile line, 70%, a high smile line, 23%, and a low smile line. 4%, 28%, and 7% of the male participants showed high, medium, and low smile lines, respectively. The Mann-Whitney U test was applied for nonparametric data, the smiling line distribution showed a significant difference between both the genders (Table 2).

Buccal corridor:

Only 23% of men and 29% of females lacked buccal corridors. Chi-square test was used to compare both the genders for the existence of buccal corridors and found to have no significant difference (Table 2)

Parallelism:

There are two types of parallelism between the lower lip line and the incisal curve: parallel and nonparallel.

37% of females and 15% of males exhibited parallel grins, whereas 24% of both sexes had nonparallel smiles. The chi-square test revealed that the parameter parallelism difference between men and women was statistically significant (Table 2).

Midline shift:

They are of two categories: 0–1 mm and 2 mm (Table 1). Dental midline shifts of 2mm or more were present in 10% of men and 20% of females. Chi – square test was utilised to analyse the distribution of midline shift was compared between males and females, but found no significant difference statistically (Table 2).

Table 1. Frequency Distribution Table of Different Smile Parameters.

Parameters		Frequency	Percentage
Gender	Male	39	39 %
	Female	61	61 %
Midline shift	0-1 mm	70	70 %
	≥ 2 mm	30	30 %
Lip line	Low	7	7 %
	Medium	70	70 %
	High	23	23 %
Parallelism	Yes	52	52 %
	No	48	48 %
Buccal corridor	Present	48	48 %
	Absent	52	52 %

Table 2. Association between Gender and Smile Parameters

Smile parameter	Criteria	Female	Male	Pearson chi-square	P value
Midline shift	0-1mm	41	29	0.578	0.29
	≥ 2mm	20	10		
Lip line	Low	16	7	1.707	0.42
	Medium	42	28		
	High	3	4		
Parallelism	Yes	37	15	4.695	0.02
	No	24	24		
Buccal corridor	Present	32	16	1.246	0.18
	Absent	29	23		

Association between Smile Parameters:

The Spearman's rho correlation test was employed to assess the relationship between the four distinct factors using nonparametric data. The midline shift and buccal corridor found to have a statistically significant positive weak relationship, according to the results ("" (rho) = 0.105, P 0.05). There was no other statistically significant correlation between smiling parameters was found (Table 3).

Table 3. Correlation Matrix for the Association of Smile Parameters

Smile parameter	Midline shift	Lip line	Parallelism	Buccal corridor
Midline shift	1.000	-0.139	0.157	0.105
Lip line	-0.139	1.000	0.184*	0.084
Parallelism	0.157	0.184*	1.000	0.042
Buccal corridor	0.105	0.084	0.042	1.000

*correlation is significant at 0.05 level.

DISCUSSION

The study's objective was to examine and assess the macro-aesthetic aspects of young people's smiles in South Chennai, including the interactions between the lips, face, teeth, and gingiva. Although few studies has been done on the smile or the dento-gingival components of young people in various other demographic zones and it has not yet been conducted within chennai or south chennai in particular. According to Tjan et al., there are three different smile lines: high, average, and low. The anterior maxillary teeth's complete cervical-incisal length, as well as a continuous band of gingiva, are visible with a high smile line. In a typical smile, between 75% and 100% of the top front teeth are visible. Less than 75% of the top anterior teeth are visible with a low smile line [16]. The average smile line, which was observed in 70% of the sample, was discovered to be the most prevalent among study participants. Within the Asser area, Alqarni et al. In comparison to a low or high smile line, authors identified that the average smile line was more frequently noticed [17]. Nold et al. also looked at the smile line in Turkish people. They discovered that while a medium smile line was more common in men, a high smile line was more common in female participants [18]. In the current study, we discovered that males (42%), who were more likely to have a high smile line, and females (42%), who were more likely to have a medium smile line. Albwardi et al. investigated the effect of buccal corridors on smile aesthetics. They came to the conclusion that a smile with considerable tooth show and 2 % buccal corridors was unappealing. A medium smile with a 10% buccal corridor, on the other hand, was deemed the most beautiful [19]. Liang et al. also investigated buccal corridors in 188 Chinese people, and found that the buccal corridors were present in about 69% of the males and 51.1% of the females [20]. In the present study, the buccal corridor was not present in 29% of females and 23% of males.

When smiling, a person's lower lip's convexity and concavity should match up perfectly to form an incisal curve. A flat or non-consonant smile is one in which the lower lip curve is more pronounced than the maxillary incisal curve [21]. A convex incisal curve was shown to be more prevalent than a non-consonant smile, according to Soares et al. Furthermore, Al-Johany et al. evaluated smile parameters of 50 people and discovered that 78% of them had an incisal curve coinciding with the lower lip [22]. With that stated, just 15% of male participants exhibited a parallel smile, whereas females had about 37% of the population. The difference in male and female participants' parallel smiles was statistically significant. The parallel smile was more common in females than in males, according to these findings, which are supported by Nold et al. There was a statistical difference in the distribution of the incisal curve across genders [18].

A critical vertical reference line is the midline. Miller et al. [23] investigated midline discrepancy and discovered that the dental midline corresponds with the face midline in 70% of cases. Furthermore, these researchers claimed that minor midline deviations have little effect on overall aesthetics. The frequency of occurrence of the midline shift was reported to be 30.7 % by Al-Balkhi and Zahrani [24.] However, we discovered that 10% of male participants had a midline shift of more than or equal to 2mm, whereas 20% of female participants had a midline shift of more than or equal to 2mm. The dental midline was measured by keeping the central incisors as a reference point, whereas the face midline was measured by keeping the philtrum. This method of assessing the midline shift is thought to be valid [23-25].

One of the study's shortcomings are the smaller sample size drawn from a small region of Tamilnadu. In order to ascertain whether there is a statistical difference in the distribution of smile parameter across different areas of Tamilnadu, a larger representative sample from various locations of state will be helpful. To precisely gauge the degree of midline displacement, face reference points were required for facial midline determination. However, obtaining frontal facial pictures was not possible due to patient privacy and identification issues. Future research may find it advantageous to include other smile characteristics as the colour of the front teeth, geometry, and proportion.

CONCLUSION

Dentogingival parameters allow the dentist to determine

the aesthetic preference hierarchy. Although aesthetics cannot be quantified, it is critical to comprehend the qualities that make up an aesthetic smile and then add changes according to the individual requirements.

Abbreviations: SPSS: Statistical Package for Social Sciences, IBM: International Business Machines

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Informed Consent: Not applicable.

REFERENCES

1. Molina IC, Molina GC, Stanley K, Lago C, Xavier CF, Volpato CA. Partial-prep bonded restorations in the anterior dentition: Long-term gingival health and predictability. A case report. Quintessence Int. 2016 Jan;47(1):9-16.
2. Chander NG. Preceptions in the principles and designing of smile. J Indian Prosthodont Soc. 2021 Apr-Jun;21(2):107-108.
3. Johnson PF. Racial norms: esthetic and prosthodontic implications. J Prosthet Dent. 1992 Apr;67(4):502-8.
4. Sharma N, Rosenstiel SF, Fields HW, Beck FM. Smile characterization by US white, US Asian Indian, and Indian populations. The Journal of Prosthetic Dentistry. 2012 May 1;107(5):327-35.
5. Farkas LG, Posnick JC, Hreczko TM. Growth patterns of the face: a morphometric study. Cleft Palate Craniofac J. 1992 Jul;29(4):308-15.
6. AlQahtani NA, Haralur SB, AlMaqbol M, AlMufarrij AJ, Al Dera AA, Al-Qarni M. Distribution of smile line, gingival angle and tooth shape among the Saudi Arabian subpopulation and their association with gingival biotype. J Int Soc Prev Community Dent. 2016 Apr;6(Suppl 1):S53-8.
7. AlQarni MA, Almnea RA, Asiri WS, Alhendi KD, AlQahtani NA. Evaluation of smile line in relation to age among Saudi population in Asser region. World J Dent. 2016 Jun 1;5(3):157-61.
8. Sarver DM, Ackerman MB. Dynamic smile visualization and quantification: Part 2. Smile analysis and treatment strategies. Am J Orthod Dentofacial Orthop. 2003 Aug;124(2):116-27.
9. Ackerman JL, Proffit WR, Sarver DM. The emerging soft tissue paradigm in orthodontic diagnosis and treatment planning. Clin Orthod Res. 1999 May;2(2):49-52.
10. Frush JP, Fisher RD. The dynesthetic interpretation of the dentogenic J.Prosthetic Den1958;8(4),558-81
11. Johnson DK, Smith RJ. Smile esthetics after orthodontic treatment with and without extraction of four first premolars. Am J Orthod Dentofacial Orthop. 1995 Aug;108(2):162-7.
12. Moore T, Southard KA, Casko JS, Qian F, Southard TE. Buccal corridors and smile esthetics. Am J Orthod Dentofacial Orthop. 2005 Feb;127(2):208-13.
13. Ackerman MB, Ackerman JL. Smile analysis and design in the digital era. J Clin Orthod. 2002 Apr;36(4):221-36.
14. Brunton PA, Ratnayake J, Loch C, Veerasamy A, Cathro P, Lee R. Indirect Restorations and Fixed Prosthodontics: Materials and Techniques Used by General Dentists of New Zealand. Int J Dent. 2019 Jan 10;2019:5210162.
15. Sfondrini MF, Debiaggi M, Zara F, Brerra R, Comelli M, Bianchi M, Pollone SR, Scribante A. Influence of lingual bracket position on microbial and periodontal parameters in vivo. J Appl Oral Sci. 2012 May-Jun;20(3):357-61.
16. Tjan AH, Miller GD, The JG. Some esthetic factors in a smile. J Prosthet Dent. 1984 Jan;51(1):24-8.
17. AlQarni MA, Almnea RA, Asiri WS, Alhendi KD, AlQahtani NA. Evaluation of smile line in relation to age among Saudi population in Asser region. World J Dent. 2016 Jun 1;5(3):157-61.
18. Nold SL, Horvath SD, Stampf S, Blatz MB. Analysis of select facial and dental esthetic parameters. Int J Periodontics Restorative Dent. 2014 Sep 1;34(5):623-9.
19. Albwardi MA, Albwardi BA, Alajlan SA, Almohareb BK, Alowairdhi AA. Perception of buccal corridors effect on smile esthetics among saudis: a survey. Int J Dental Health Sci. 2017;4:13.
20. Liang LZ, Hu WJ, Zhang YL, Chung KH. Analysis of dynamic smile and upper lip curvature in young Chinese. Int J Oral Sci. 2013 Mar;5(1):49-53.
21. Sarver DM. The importance of incisor positioning in the esthetic smile: the smile arc. Am J Orthod Dentofacial Orthop. 2001 Aug;120(2):98-111.
22. Al-Johany SS, Alqahtani AS, Alqahtani FY, Alzahrani AH. Evaluation of different esthetic smile criteria. Int J Prosthodont. 2011 24(1):64- 70.
23. Miller EL, Bodden WR Jr, Jamison HC. A study of the relationship of the dental midline to the facial median line. J Prosthet Dent. 1979 Jun;41(6):657-60.
24. Al-Balkhi K, Al-Zahrani A. The pattern of malocclusions in Saudi Arabian patients attending for orthodontic treatment at the College of Dentistry, King Saud University, Riyadh. Saudi Dent J. 1994;6(3):138-44.
25. Mohan MP, AlOlayan RA, AlSweed MA. Dentogingival Smile Analysis of Young Adults of Al Qassim Province, Saudi Arabia: A Cross-Sectional Study. Int J Dent. 2020,10;2020:8855681.