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An esthetic evaluation of different characteristics of smile in general population

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ABSTRACT

Background: The smile is one of the most effective ways by which people convey their emotions and it also increases the self-confidence of an individual. The evaluation of smile design and characteristics plays an important role in diagnosis and treatment planning phase of prosthodontics. However, these smile characteristics may vary between male and female. The present study is to evaluate the different characteristics of smile by using eight parameters between male and female. These parameter helps the prosthodontist to achieve the patient demands. Aim: To evaluate the different characteristics of smile by using eight parameters between male and female.

Materials and method: Frontal view digital photographs were obtained under posed smile and unposed smile of 180 dental students were assessed (n=90 males and n=90 females) with mean age of 20-30 years. Different characteristics were recorded such as maxillary interincisal midline, smile line, smile arc, smile type, upper lip curvature, shape of the teeth, Teeth displayed and labiodental relationship. Data were analyzed using SPSS version 23.0. Pearson chi-square test was used to determine the gender-based differences for various characteristics.

Results: Gender based differences were not statistically significant except for smile arc and number of teeth displayed. There was a significant relationship between lip curvature and smile pattern and lip curvature and smile arc revealing that upward lip curvature was associated with commissure type smiles and consonant smile arc.Conclusion: Thus, the knowledge of different characteristics of smile between male and female are important for prosthodontist while designing the smile makeover.

Keywords: Smile line, smile arc, upper lip curvature, smile pattern, labiodental relationship, smile type.

INTRODUCTION

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Smile designing is a comprehensive process that involves evaluating and studying the oral structures, including teeth, gums, and lips, in order to make improvements that enhance the overall appearance of the face. By using the principles of aesthetic dentistry, dental professionals can create a smile that not only looks beautiful but also functions well.

During the smile design process, various factors are considered, such as the shape and size of the teeth, their alignment, color, symmetry, and how they relate to the surrounding facial features. The goal is to create a harmonious and balanced smile that complements the individual's unique facial characteristics.(1)

The goal of an aesthetic makeover, or smile design, extends beyond just creating a visually pleasing smile. It aims to establish a stable masticatory system, where all the components involved in the process of chewing (teeth, tissues, muscles, skeletal structures, and joints) work together harmoniously.(2) By addressing all these elements and achieving harmony among them, an aesthetic makeover can create a stable masticatory system. This not only improves oral function but also contributes to the long-term stability and health of the teeth, gums, muscles, and joints.

While Pierre Fauchard is widely recognized as the father of modern dentistry, it is important to note that the concept of aesthetic dentistry and its promotion did not originate with him. Fauchard's significant contributions to dentistry primarily focused on advancements in dental techniques, oral surgery, and the understanding of dental anatomy and diseases during the 17th and 18th centuries.

It was in the 20th century that the field of aesthetic dentistry began to evolve, with several pioneers contributing to its development. These pioneers, along with their colleagues, played crucial roles in modernizing and promoting aesthetic practices in dentistry.

One notable figure in the advancement of aesthetic dentistry is Dr. Charles L. Pincus, an American dentist. In the 1930s, Dr. Pincus developed and introduced the concept of dental veneers, which allowed for the transformation of smiles by improving the appearance of teeth. His innovative approach laid the foundation for future aesthetic dental procedures.

Another significant contributor to aesthetic dentistry was Dr. Michael Buonocore. In the 1950s, he discovered the concept of acid etching, which revolutionized bonding techniques in dentistry. This breakthrough led to the development of tooth-colored restorative materials, such as composite resins, enabling more aesthetically pleasing dental fillings.

Dr. Irwin Smigel, often referred to as the "Father of Aesthetic Dentistry," was another influential figure. He popularized techniques such as tooth whitening and cosmetic contouring, further advancing the field of aesthetic dentistry.

These pioneers, along with numerous other dentists and researchers, collectively contributed to the modernization and promotion of aesthetic dentistry. Their innovative ideas, techniques, and materials have significantly influenced the practice of dentistry, allowing for the integration of aesthetics and oral health to enhance patients' smiles and overall well-being.(3)It's important to note that the characteristics of a smile can vary from person to person. Several factors can influence the appearance of a smile, including age, gender, and malocclusion.(4)Photographs are often used as a valuable tool to aid in the evaluation of smile characteristics. They provide a visual reference that allows the prosthodontist to analyze and assess various aspects of the smile in detail.

Having a thorough understanding of smile characteristics is essential for a prosthodontist when planning and executing a smile makeover or any other prosthodontic treatment. This knowledge helps in selecting the appropriate dental restorations, materials, and treatment techniques to enhance the patient's smile and achieve optimal aesthetic outcomes.The present study aimed to evaluate the different characteristics of a smile using seven parameters and compare them between males and females. These parameters serve as valuable tools for prosthodontists to understand and fulfill the desires and demands of their patients when it comes to achieving an aesthetically pleasing smile.

MATERIALS AND METHODS

The study aimed to assess the characteristics of smile in a sample of 190 participants, consisting of 95 males and 95 females. The participants were selected based on specific inclusion and exclusion criteria.

Inclusion Criteria:

1. Healthy Dentition: Participants had a complete set of permanent teeth, excluding third molars (wisdom teeth), with no missing or supernumerary teeth.

2. Overjet and Overbite: Participants had overjet (horizontal overlap of upper and lower front teeth) and overbite (vertical overlap of upper and lower front teeth) within the range of 2 to 5 mm.

3. Periodontal Health: Participants had no active periodontal disease and had not undergone any periodontal treatment, except for routine scaling and polishing.

4. Normal Upper Lip Length: Participants had a normal upper lip length.

5. No Craniofacial Anomalies or Pathologies: Participants did not have any craniofacial anomalies or other pathological conditions that could influence smile characteristics.

6. No Severe Malocclusion: Participants did not have severe malocclusion, which refers to significant misalignment of the teeth or jaws.

7. No Canting of Maxillary Occlusal Plane: Participants did not have a noticeable inclination or angulation of the upper occlusal (bite) plane.

Exclusion Criteria:

1. Acquired or Congenital Defect: Participants with acquired or congenital defects that could impact smile characteristics were excluded.

2. Facial Asymmetry: Participants with noticeable facial asymmetry were excluded.

3. Active Caries: Participants with active caries were excluded.

4. Crowding or Malpositioning of Teeth: Participants with crowded or severely mispositioned teeth were excluded.

5. Orthodontic Treatment: Participants who had undergone orthodontic treatment that could have altered their smile characteristics were excluded.(5)

The study utilized standardized photographs obtained with a DSLR camera (Nikon, model D3100) equipped with an 18-55mm lens. The camera was stabilized using a tripod and positioned at a distance of 40mm from the participant, with a white wall serving as the background. To avoid the shadow effect, the participant was positioned 10mm away from the wall. This positioning helps ensure clear and consistent images for evaluation.

The obtained photographs were then assessed using Adobe Photoshop version 7.0 or later versions. Photoshop is a widely used image editing software that allows for detailed analysis and evaluation of various parameters .(6,7)The seven characteristics of the smile that were evaluated in the study are as follows:

Dental midline.

Labiodental relationship.

Smile line.

Smile width.

Smile arc.

Smile type.

Upper lip curvature.

MIDLINE:

The midline refers to the imaginary line that runs vertically through the centre of the face, from the nasion (the point between the eyes where the nose and forehead meet) to the philtrum (the vertical groove on the upper lip below the nose). It can be classified as either central (aligned with the facial midline) or deviated based on its position in relation to this line. (8,9)

SMILE LINE:

The smile line, also known as the lip line, refers to the vertical position of the lower border of the upper lip. There are three types of smile lines: low, average, and high smile lines.

• A low smile line indicates that less than two-thirds of the maxillary (upper) anterior teeth or less than 75% of their clinical crown is visible when smiling.

• An average smile line shows 75% to 100% of the clinical crown of the maxillary anterior teeth, with only the interdental papilla being visible.

• A high smile line reveals not only the maxillary anterior teeth but also about 2mm of the continuous maxillary gingiva.(7,8,10)

SMILE ARC:

The smile arc refers to the relationship between the curvature of the incisal edges of the maxillary incisors and canines and the curvature of the lower lip. Smile arc can be classified into two categories: consonant smile arc and non-consonant smile arc.

Consonant smile arc:

In a consonant smile arc, the curvature of the incisal edges of the maxillary anterior teeth is parallel to the lower border of the lower lip.

Non-consonant smile arc:

The non-consonant smile arc can be further divided into two subcategories: reverse and straight.

Reverse smile arc:

In a reverse smile arc, the incisal edges of the maxillary anterior teeth are curved in the opposite direction, or reverse, to the upper border of the lower lip.. This type of smile arc may be considered less harmonious or less ideal in terms of esthetics.

Straight smile arc:

A straight smile arc refers to a smile where the incisal edges of the maxillary anterior teeth form a straight line in relation to the upper border of the lower lip. This type of smile arc may also be considered less harmonious or less ideal from an esthetic perspective. (7,8,10,11)

SMILE TYPE:

There are three patterns of smile design: commissure, cuspid, and complex smile types. Each type is characterized by the positioning and movement of the teeth and lips during a smile.

1. Commissure smile type: In the commissure smile type, the maxillary first molar is located a few millimeters above the incisal edge of the maxillary central incisor. This positioning creates a smile pattern that resembles a cupid's bow, as the curvature of the molar gives a rounded appearance to the smile.

2. Cuspid smile type: In the cuspid smile type, the maxillary first molar is positioned either inferiorly or at the same level as the incisal edge of the maxillary central incisor. This creates a smile pattern that resembles a diamond shape, as the cuspid teeth (canines) are prominent and give a pointed appearance to the smile.

3. Complex smile type: The complex smile type involves a more intricate movement of the lips during a smile. In this type, the upper lip moves superiorly (upwards) while the lower lip moves inferiorly (downwards). This movement results in the display of two parallel chevrons (V-shaped patterns) that show all of the upper and lower teeth.(12)

UPPER LIP CURVATURE:

The line is drawn from the inferior border of the upper lip to the corner of the mouth. Based on the position of the corner of the mouth in relation to this line, the upper lip curvature can be classified as upward, straight, or downward

1.Upward upper lip curvature: In this pattern, the corner of the mouth lies above the horizontal line drawn from the inferior border of the upper lip to the corner of the mouth. The upper lip has an upward or elevated curvature, creating a smile that appears to have a more pronounced or lifted upper lip.

2.Straight upper lip curvature: In a straight upper lip curvature, the corner of the mouth is positioned either directly on the horizontal line or within 1mm of the line. The upper lip maintains a relatively neutral or straight alignment, without significant elevation or downturn.

3.Downward upper lip curvature: The downward upper lip curvature is characterized by the corner of the mouth lying below the horizontal line. The upper lip has a downturned or drooping appearance, as the corner of the mouth is

positioned lower than expected based on the line drawn.(7,13)

LABIODENTAL RELATIONSHIP:

The labiodental relationship refers to the relationship between the lower lip and the maxillary anterior teeth. It is determined by evaluating the distance between the superior border of the lower lip and the inferior border of the maxillary anterior teeth.The labiodental relationship can be classified into two types:

1. Slightly touching: In this type, the lower lip is observed to be slightly touching the maxillary anterior teeth. There is a minimal contact or overlap between the lower lip and the edges of the upper front teeth. This indicates that the lower lip rests in close proximity to the maxillary anterior teeth without exerting significant pressure or force.

2. Non-touching: In the non-touching type, the lower lip does not touch or make contact with the maxillary anterior teeth. There is a visible gap or space between the lower lip and the edges of the upper front teeth. This suggests that the lower lip is positioned slightly away from the maxillary anterior teeth and does not rest against them.

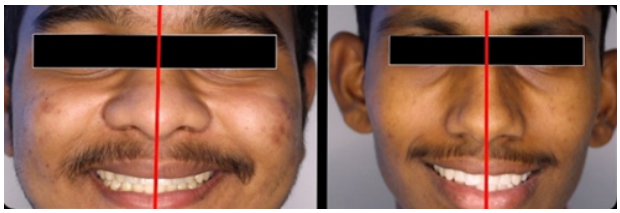






Fig 1. 1.Midline (a)central, (b) deviated, 2. Smile line (a) low, (b) average, (c) high, 3. Smile arc (a) consonant,(b) non-consonant: i. straight , ii. Reverse.



Fig 2: 4.Upper lip curvature i.upward, ii. Straight, iii. Downward , 5. Labiodental relationship i. slightly touching, ii. Not touching, 6. Smile type i. commissure ,ii. Cuspid,iii.complex 7.. i. canine, ii. First premolar, ii. Second premolar, iii. First molar

SMILE WIDTH:

Smile width refers to the measurement of the horizontal extent of the smile, specifically the number of teeth that are visible or exposed when a person smiles. It is evaluated by observing the teeth that can be seen within the smile.

The classification of smile width is typically based on the number of teeth observed. Here are the common classifications:

1. Up to canine: In this classification, the smile width includes the teeth visible up to the maxillary canines. The visible teeth comprise the central incisors, lateral incisors, and canines.

2. Up to first premolar: In this classification, the smile width extends to the first premolars. The visible teeth include the central incisors, lateral incisors, canines, and first premolars.

3. Up to second premolar: Here, the smile width includes the teeth visible up to the second premolars. The visible teeth encompass the central incisors, lateral incisors, canines, first premolars, and second premolars.

4. Up to first molar: In this classification, the smile width extends to the first molars, which are the larger teeth located behind the premolars. The visible teeth include the central incisors, lateral incisors, canines, first premolars, second premolars, and first molars.(7,8,10,11)

RESULTS

Regarding smile characteristics, the most common smile line observed among the subjects was the average smile line, followed by the low smile line. The most prevalent smile type was the cuspid smile, followed by the commissure smile and then the complex smile type. Upward lip curvature was observed in the majority of individuals, while an equal distribution of downward and straight lip curvatures was observed.

No statistically significant gender-based differences were found for smile line, smile type, or upper lip curvature. Additionally, most participants had their maxillary anterior teeth not covered by the lower lip during smile, and there were no statistically significant differences between genders in this regard.

The study found that consonant smile arcs were more common among the participants, followed by flat or straight arcs. A statistically significant difference was observed between males and females in terms of smile arcs (p value = 0.001). Consonant smiles were more common in females, while flat smiles were more common in males.

Regarding the extent of teeth displayed during smile, the majority of subjects had their teeth displayed up to the first premolars. However, a few participants had their first molars visible during smile. Statistically significant gender differences were observed in this aspect (p value < 0.001). Males were more likely to have a broader smile, displaying teeth up to the first molars, while females were more likely to display teeth up to the first premolars.

These findings suggest that there are gender differences in smile arcs and the extent of teeth displayed during smile. Females tend to have more consonant smiles, while males have a higher likelihood of displaying a flat smile. Additionally, males generally have a broader smile, showing teeth up to the first molars, while females are more likely to display teeth up to the first premolars. The study revealed a significant association between upper lip curvature and smile design (p value < 0.001). Commissure smiles were found to be associated with upward lip curvature, while cuspid smiles were associated with straight lip curvatures, and gummy smiles were associated with downward lip curvatures. This suggests that the curvature of the upper lip plays a role in determining the type of smile exhibited by individuals.

Furthermore, a significant relationship between lip curvature and smile arc (p value = 0.01) was observed. More subjects with upward lip curvature were found to have a consonant smile arc, indicating that the position of the smile arc is influenced by the curvature of the upper lip.These findings highlight the interplay between upper lip curvature, smile design, and smile arc, emphasizing the importance of considering lip characteristics when assessing and planning aesthetic treatments for individuals.

Table 1: Frequency and percentage of the interincisal midline versus facial midline in the sample according to gender

GENDER	MIDLINE		Chi square value	P value
	CENTRAL N (%)	DEVIATED N (%)		
MALE	70 (49.6%)	25	0.28	0.5
FEMALE	71(50.4%)	24		
TOTAL	141	49		

Table 2 Frequency and percentage of the smile line in the sample according to gender

GENDER	SMILE LINE			Chi square value	P value
	LOW	AVERAGE	HIGH		
MALE	20	50	25	0.88	0.64
FEMALE	15	53	27		
TOTAL	35	103	52		

Table 3 Curve of the upper lip in the sample according to gender

GENDER	UPPER LIP CURVATURE			Chi square value	P value
	UPWARD	STRAIGHT	DOWNWARD		
MALE	25	48	22	59.618	0.0001
FEMALE	78	11	6		
TOTAL	103	59	28		

Table 4 Smile arc in the sample according to gender

GENDER	SMILE ARC			Chi square	P value
	CONSONANT N (%)	STRAIGHT N (%)	REVERSE N (%)		
MALE	25	36	34	38.963	0.001
FEMALE	67	19	9		
TOTAL	92	55	43		

Table 5: Width of the smile in the sample according to gender

GENDER	SMILE WIDTH				Chi square value	P value
	CANINE N(%)	FIRST PREMOLAR	SECOND PREMOLAR	FIRST MOLAR		

MALE	11	52	21	11	1.108	0.775
FEMALE	7	56	22	10		
TOTAL	18	108	43	21		

Table 6 Smile type in the sample according to gender

GENDER	SMILE TYPE			Chi square	P value
	COMMISURE	CUSPID	COMPLEX		
MALE	51	34	10	39.61	0.0001
FEMALE	13	45	37		
TOTAL	64	79	47		

Table 7: Labiodental relationship in the sample according to gender.

GENDER	LABIODENTAL RELATIONSHIP		Chi square value	P value
	SLIGHTLY TOUCHING	NOT TOUCHING		
MALE	22	73	0.115	0.433
FEMALE	24	71		

DISCUSSION

The present study acknowledged that ethnicity and age are important factors influencing smile characteristics, as noted in previous research. To ensure a homogeneous sample of subjects, the study clearly defined inclusion and exclusion criteria based on these factors. By doing so, the researchers aimed to minimize potential confounding variables and obtain a more accurate understanding of the specific aesthetic parameters under investigation.

In this present study, it was observed that there is no significant difference between male and female facial for midline(9). Silva et al. conducted research and determined that a threshold of 2 mm is the point at which deviations of the maxillary interincisal midline from the facial midline become perceptible. There was a no significant difference in gender for smile width.

The most common smile line among the participants was average smile line. This implies that the majority of individuals in the study had a smile line where the gingiva is displayed within normal ranges, resulting in a more aesthetically pleasing appearance. By recognizing the prevalence of an average smile line in the studied population, there is no significant difference in gender for smile line. (14)Among the participants of this study, the most commonly observed smile arc was consonant, while the least frequent was the reverse smile arc. The consonant smile arc is more significant in female than male. An upward lip curvature was the most prevalent feature observed in the participant of study. The upward lip curvature is more prevalent in female than male.A large proportion of the subjects exhibited a cuspid smile pattern.(15) Male participants had more commissure smile pattern, while the cuspid smile pattern was primarily observed in females.

The majority of participants exhibited a non-touching labiodental relationship, followed by relatively few participants with covering and slightly touching relationships. Furthermore, the present study did not find any statistically significant gender-based differences in this aspect. The present study suggests that males have wider smiles, exposing more teeth than females. Smile width is more significant upto the level of canine for females and till first molar for male.

CONCLUSION

Based on the study's constraints, we can infer that the observed sample displayed characteristics such as an average smile line, consonant smile arcs, a cuspid-type smile, an upward lip curvature, a non-touching relationship between the maxillary anterior teeth and the lower lip, and the visibility of teeth up to the first premolars. These findings hold relevance for incorporating smile analysis in individuals prior to commencing aesthetic treatments. Additionally, it is imperative to evaluate each case on an individual basis, taking into account the patient's expectations and preferences, to achieve satisfactory outcomes in oral rehabilitation.

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