Assessment of Vertical Anterior Teeth Display and Lip Position at Smiling

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Abstract:

Background: Smile aesthetics are influenced by the harmonious relationship between the maxillary anterior teeth, gingiva, lips and surrounding facial structures. Vertical anterior teeth display and upper lip position during smiling are important parameters in orthodontic diagnosis and aesthetic dental treatment planning. The present study aimed to assess vertical anterior teeth display and evaluate upper lip position during smiling among healthy adults. **Materials and Methods:** The present observational cross-sectional study included 40 healthy adult subjects aged 18–35 years. Demographic characteristics, including age and gender, were recorded. Standardized extraoral photographs were obtained at rest and during maximum posed smiling. Maxillary anterior teeth display, upper lip length, upper lip elevation, gingival exposure and interlabial gap were measured using calibrated image analysis software. Smile line patterns were categorized as high, average and low. The collected data were analysed using appropriate descriptive and inferential statistical methods. **Results:** Among the 40 participants, 18 (45%) belonged to the 18–25 years age group, while 14 (35%) and 8 (20%) belonged to the 26–30 and 31–35 years age groups, respectively. Equal gender distribution was observed. The mean upper lip length at rest was 21.45 ± 2.18 mm, while maxillary central incisor display at rest was 2.65 ± 1.12 mm. The mean maxillary anterior teeth display during smiling was 9.24 ± 1.46 mm, with an average upper lip elevation of 6.82 ± 1.35 mm. Mean gingival display and interlabial gap during smiling were 1.38 ± 1.21 mm and 12.65 ± 2.14 mm, respectively. The average smile line was the most prevalent pattern, observed in 22 (55%) participants, followed by low smile line in 10 (25%) and high smile line in 8 (20%) participants.Gender-wise comparison demonstrated significantly greater maxillary central incisor display at rest, anterior teeth display during smiling, upper lip elevation and gingival exposure among females compared with males. **Conclusion:** The study demonstrated variations in vertical anterior teeth display and upper lip position during smiling, with the average smile line being the most frequently observed pattern. Evaluation of these parameters may contribute to improved aesthetic assessment and individualized orthodontic and prosthodontic treatment planning.

Keywords: Anterior Teeth Display, Smile Aesthetics, Upper Lip Position, Gingival Display, Smile Line, Dental Aesthetics.

Introduction:

Smile is an important component of facial aesthetics and plays a significant role in an individual's appearance, self-confidence and social interactions. An attractive smile is determined by the harmonious relationship between the teeth, gingiva, lips and surrounding facial structures. The position and visibility of the maxillary anterior teeth, particularly the central incisors, are considered important determinants of smile aesthetics. Variations in the vertical display of anterior teeth can influence the overall balance and attractiveness of the smile.[1, 2]

Vertical anterior teeth display is influenced by several anatomical and functional factors, including upper lip length, lip mobility, tooth dimensions, gingival position and facial proportions. During smiling, the upper lip moves superiorly, exposing varying amounts of maxillary anterior teeth and gingival tissues. Excessive gingival exposure may result in a gummy smile, whereas inadequate exposure of the maxillary incisors may produce an aged or less aesthetically

pleasing appearance. Previous studies have demonstrated that age and gender can influence incisor display, upper lip position and smile characteristics.[3- 5]

Assessment of vertical anterior teeth display and lip position is therefore essential in orthodontic diagnosis, prosthodontic rehabilitation and aesthetic dental treatment planning. Standardized clinical photography and smile analysis provide useful methods for evaluating dental exposure, upper lip elevation and gingival display during smiling. Understanding these parameters helps clinicians establish appropriate aesthetic guidelines and achieve harmonious relationships between the teeth and soft tissues.[6- 8] Therefore, the present study was undertaken to measure vertical anterior teeth display and evaluate lip position during smiling.

Materials and methods:

The present observational cross-sectional study was conducted among 40 healthy adult subjects to assess vertical anterior teeth display and lip position during smiling. Subjects within the age group of 18–35 years were included after obtaining informed consent. Individuals with missing maxillary anterior teeth, gross dental abnormalities, previous orthodontic or maxillofacial surgical treatment, congenital facial deformities or significant lip abnormalities were excluded. Demographic details, including age and gender, were recorded for all participants.

Clinical examination and standardized extraoral photographs were performed with subjects in a natural head position. Photographs were obtained in two conditions: at rest and during maximum posed smiling, using a digital camera positioned at a standardized distance. The vertical display of maxillary anterior teeth was measured in millimetres, along with upper lip length, upper lip elevation and gingival exposure during smiling. Smile line was categorized according to the amount of tooth and gingival display. Measurements were recorded using calibrated image analysis software, and the collected data were analysed using descriptive statistics, independent-sample t-test and chi-square test, wherever appropriate. A p-value of less than 0.05 was considered statistically significant.

Results:

A total of 40 participants were enrolled.

Table: 1. Demographic distribution of the study participants (n=40)

Parameter	Frequency (n)	Percentage (%)
Age group		
18–25 years	18	45.0
26–30 years	14	35.0
31–35 years	8	20.0
Gender		
Male	20	50.0
Female	20	50.0
Total	40	100.0

Among the 40 participants, 18 (45%) belonged to the 18–25 years age group, followed by 14 (35%) aged 26–30 years and 8 (20%) aged 31–35 years. Equal gender distribution was observed, with 20 (50%) males and 20 (50%) females.

Table: 2. Measurement of vertical anterior teeth display and lip position (n=40)

Parameters	Mean	SD
Upper lip length at rest (mm)	21.45	2.18
Maxillary central incisor display at rest (mm)	2.65	1.12
Maxillary anterior teeth display during smiling (mm)	9.24	1.46
Upper lip elevation during smiling (mm)	6.82	1.35
Gingival display during smiling (mm)	1.38	1.21
Interlabial gap during smiling (mm)	12.65	2.14

The mean upper lip length at rest was 21.45 ± 2.18 mm, while maxillary central incisor display at rest was 2.65 ± 1.12 mm. During smiling, the mean anterior teeth display increased to 9.24 ± 1.46 mm, with an average upper lip elevation of 6.82 ± 1.35 mm. The mean gingival display was 1.38 ± 1.21 mm.

Table: 3. Distribution of smile line patterns among study participants (n=40)

Smile line pattern	Frequency (n)	Percentage (%)
High smile line	8	20.0
Average smile line	22	55.0
Low smile line	10	25.0
Total	40	100.0

The average smile line was the most commonly observed pattern, accounting for 22 (55%) participants, followed by low smile line in 10 (25%) participants. High smile line was observed in 8 (20%) participants, indicating considerable variation in vertical anterior teeth and gingival display during smiling.

Table. 4: Gender-wise comparison of vertical anterior teeth display and lip position (n=40)

Parameters	Male (n=20) Mean ± SD	Female (n=20) Mean ± SD	p-value
Upper lip length at rest (mm)	22.30 ± 1.85	20.60 ± 1.95	0.008*
Maxillary central incisor display at rest (mm)	2.10 ± 0.95	3.20 ± 1.05	0.001*
Anterior teeth display during smiling (mm)	8.65 ± 1.30	9.83 ± 1.35	0.008*
Upper lip elevation during smiling (mm)	6.20 ± 1.20	7.44 ± 1.25	0.003*
Gingival display during smiling (mm)	0.95 ± 0.90	1.81 ± 1.25	0.016*
Interlabial gap during smiling (mm)	11.90 ± 1.95	13.40 ± 2.10	0.024*

*: Significant

Gender-wise comparison demonstrated significantly greater maxillary central incisor display at rest, anterior teeth display during smiling, upper lip elevation and gingival exposure among females compared with males.

Discussion:

Smile aesthetics play a significant role in facial appearance and are influenced by the harmonious relationship between the maxillary anterior teeth, gingiva and surrounding soft tissues. Vertical anterior teeth display and upper lip position are important determinants of smile attractiveness, as variations in tooth visibility, lip length, lip elevation and gingival exposure can considerably influence smile appearance. These parameters are affected by anatomical characteristics, age, gender and individual lip mobility. Their clinical assessment is essential in orthodontic diagnosis, prosthodontic rehabilitation and aesthetic dental treatment planning.[9- 12] Therefore, the present study was undertaken to measure vertical anterior teeth display and evaluate lip position during smiling among adult individuals.

Among the 40 participants, 18 (45%) belonged to the 18–25 years age group, while 14 (35%) and 8 (20%) belonged to the 26–30 and 31–35 years age groups, respectively. Equal gender distribution was observed. The mean upper lip length at rest was 21.45 ± 2.18 mm, while maxillary central incisor display at rest was 2.65 ± 1.12 mm. The mean maxillary anterior teeth display during smiling was 9.24 ± 1.46 mm, with an average upper lip elevation of 6.82 ± 1.35 mm. Mean gingival display and interlabial gap during smiling were 1.38 ± 1.21 mm and 12.65 ± 2.14 mm, respectively. The average smile line was the most prevalent pattern, observed in 22 (55%) participants, followed by low smile line in 10 (25%) and high smile line in 8 (20%) participants.Gender-wise comparison demonstrated significantly greater maxillary central incisor display at rest, anterior teeth display during smiling, upper lip elevation and gingival exposure among females compared with males. Al-Kaisy N et al, investigated the effect of age and gender on the amount of maxillary anterior teeth and associated lip position during smiling in the Kurdish population to establish guidelines for rehabilitating edentulous patients.There were no

significant age or sex differences in the anterior teeth display of posed smile. However, women displayed more maxillary anterior teeth in both age groups. The highest display was for lateral incisors, followed by central incisors and canine (61.3%, 58.9%, and 49.05% in the young group vs 62.05%, 54.5%, and 53.3% in the old group). On the other hand, a significant age difference was observed in dentogingival display of maxillary anterior teeth during a spontaneous smile, including mainly the lateral incisors length with their overlying gingiva (98.5%, 1.46 mm in young vs 92.1%, 0.47 mm in old). Women show insignificant excess gingival display than men. Low smile line (class IV) was the predominant type of smile in posed smiles (60%-62.5%). While the average smile line (class III) was the dominant type of young (52.5%) and the high (class II) of old (40%) in spontaneous smiles.[13] Van Der Geld P et al, in another similar study, analysed differences in tooth display, lip-line height, and smile width between the posed smiling record, traditionally produced for orthodontic diagnosis, and the spontaneous (Duchenne) smile of joy.The faces of 122 male participants were each filmed during spontaneous and posed smiling. Spontaneous smiles were elicited through the participants watching a comical movie. Maxillary and mandibular lip-line heights, tooth display, and smile width were measured using a digital videographic method for smile analysis. Paired sample t-tests were used to compare measurements of posed and spontaneous smiling.Maxillary lip-line heights during spontaneous smiling were significantly higher than during posed smiling. Compared to spontaneous smiling, tooth display in the (pre)molar area during posed smiling decreased by up to 30%, along with a significant reduction of smile width. During posed smiling, also mandibular lip-line heights changed and the teeth were more covered by the lower lip than during spontaneous smiling.[14]

Conclusion:

The study demonstrated variations in vertical anterior teeth display and upper lip position during smiling, with the average smile line being the most frequently observed pattern. Assessment of these parameters provides valuable clinical information for achieving harmonious dental and facial aesthetics during orthodontic and prosthodontic treatment planning.

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