

# Smile Line and Periodontium Visibility

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This multi-center study evaluated periodontium visibility during natural and forced smile based on a new classification. The study population consisted of 576 patients (364 women and 212 men) aged from 21 to 78 years. All the participants' teeth from first right premolar to first left premolar were present and the periodontium was healthy. Clinical photographs of the participants smiles were taken and the smile line analyzed according to the following 4 classifications: 1) more than 2 mm of marginal gingiva visible or more than 2 mm apical to the cemento-enamel junction visible for the reduced but healthy periodontium; 2) between 0 and 2 mm of marginal gingiva visible or between 0 and 2 mm apical to the cemento-enamel junction visible for the reduced but healthy periodontium; 3) only gingival embrasures visible; and 4) gingival embrasures and cemento-enamel junction not visible. Patients were also classified by age group and gender. With natural smile analysis revealed the following: Class 1, 4.69%; Class 2, 8.16%; Class 3, 44.79%; and Class 4, 42.36%. With forced smile analysis revealed the following: Class 1, 22.22%; Class 2, 21.35%; Class 3, 45.49%; and Class 4, 10.94%. The periodontium was more visible in the forced smile than in the natural smile. Age and gender influenced the position of the smile line for only the natural smile. Concern was expressed about esthetics by participants in 89.06% of the cases. Examination of periodontium visibility must be performed both for natural and forced smile.

**Key words:** smile, smile line, aesthetic, periodontium

A patient's smile expresses a feeling of joy, success, sensuality, affection and courtesy, and reveals self-confidence and kindness. A smile is more than a method of communicating, it is a means of socialization and attraction whose advantages are taken for granted in the media, both publicly and politically (Gandet, 1987). This media portrayal of the stereotyped smile leads to a standardization of the smile and consequently to an increase in aesthetic demand from patients (Morley and Eubank, 2001).

The harmony of the smile is determined not only by the shape, the position and the color of teeth but also by the gingival tissues. The gingival margin should be healthy and harmonious and today both patients and dentists are more aware of the impact of the gingiva on the beauty of the smile (Towsend, 1993). In particular, the periodontist

can influence the appearance of the patient's smile (Garber and Salama, 1996; Dolt and Robbins, 1997; Glise et al, 1999; Borghetti and Monnet-Corti, 2000).

Periodontium visibility depends on the position of the smile line, which is defined as the relationship between the upper lip and the visibility of gingival tissues and teeth. The smile line is an imaginary line following the lower margin of the upper lip and usually has a convex appearance (Towsend, 1993; Morley and Eubank, 2001) (Fig. 1). Few publications exist regarding the relationship between teeth and periodontium visibility during the smile. In a study of 425 students Crispin and Watson (1981) reported that the gingival margin was visible in 66% of the participants in natural smile. With maximal smiling, 84% of the participants revealed their gingival margin. Tjian et al



Fig. 1 The smile line.



Fig. 2 The natural smile.



Fig. 3 The forced smile.

(1984) examined 454 young adults and classified them into 3 categories according to the position of the smile line. The study used the following classification: 1) the smile line is above the cemento-enamel junctions, the 'gummy smile'; 2) the smile line reveals interproximal gingiva; and 3) the smile line reveals less than 75% of the anterior maxillary teeth. Class 1 accounted for 10.6%; Class 2 accounted for 68.9%; and Class 3 accounted for 20.5%. The authors concluded that when patients presented a 'gummy smile', esthetics was the prime requirement; when patients uncovered the interproximal gingiva, esthetics was still important; and when the smile line was under 75% of the anterior maxillary teeth, the impact of esthetics was less. This classification, based on the proportion of teeth uncovered, did not specify the type of smile. Jensen et al (1999) photographed 733 participants during a smile with teeth in nor-

mal contact. The authors divided the position of the smile line into 4 categories based on the part of the interproximal papilla that was visible: 1) the low smile line estimated as less than 25% of the visible interproximal gingiva and no visible margins; 2) the average smile line estimated as 25–75% of the interproximal visible gingiva and possibly visible gingival margins for a single tooth; 3) the high smile line estimated as more than 75% of the visible interproximal gingiva and scarcely visible gingival margins; and 4) the very high smile line represented a band of at least 2 mm continuously visible maxillary gingiva. Class 4 did not allow for the differentiation of participants presenting visible interproximal gingiva compared to those that did not reveal their periodontium at all.

The parameters used by Crispin and Watson (1981), and Jensen et al (1999), did not include information for participants that had lost interprox-

imal papilla even when the lack of papilla represented aesthetic damage and was a major reason for complaint by the patients. Tjian et al (1984) did not specify the type of smile and Jensen et al (1999) only evaluated the natural smile.

Two key points need to be included when determining periodontium visibility. Firstly, the practitioner has to look not only at marginal gingiva visibility (the stage before the 'gummy smile'), but also at the visibility of gingival embrasures, and classification must be based on this principle. Secondly, the practitioner needs to consider both the natural smile (Fig. 2) and the forced smile (Fig. 3) when evaluating the position of the smile line. When the practitioner asks a patient to smile, the patient usually takes a cautious attitude and reveals a more or less natural smile. However, outside of the office, the patient can reveal more periodontium by forcing the smile to the maximum degree of lip contraction, thereby making the smile less esthetically pleasing.

The purpose of this study was to establish the frequency of periodontium visibility during natural and forced smile based on a new classification.

## MATERIAL AND METHODS

### *Selection of Participants*

The 576 participants in this multi-center study comprised patients of private practices. All the participants were informed of the purpose of the study and consented to participate. Participants were selected based on the following criteria: 1) older than 21 years of age; 2) at least 8 contiguous anterior and superior teeth equally distributed between right and left side; and 3) a healthy periodontium or a reduced but healthy one. Patients were excluded if they had a prosthesis because this might have affected esthetics or periodontal health. Gender and age were recorded for each participant. Participants were classified into 3 groups according to age: 21–35 years, 36–50 years, and more than 50-years old.

### *Methods*

All the participants were photographed to evaluate their smile line. The headrest was aligned to allow positioning of the head in the Frankfort hori-

zontal plane to assure optimal angulation. Two different pictures were taken of each participant: one during natural smile, and another one during forced smile. The position of the smile line during natural and forced smile was determined from the pictures by a group of seven examiners.

The smile lines were analyzed according to the following classification:

**Class 1. Very high smile line:** more than 2 mm of marginal gingiva visible or more than 2 mm apical to the cemento-enamel junction visible for the reduced but healthy periodontium. This could be the 'gummy smile' (Fig. 4a).

**Class 2. High smile line:** between 0 and 2 mm of marginal gingiva visible or between 0 and 2 mm apical to the cemento-enamel junction visible for the reduced but healthy periodontium (Fig 4b).

**Class 3. Average smile line:** gingival embrasures only visible (Fig. 4c).

**Class 4. Low smile line:** gingival embrasures and cemento-enamel junctions not visible (Fig. 4d).

All the smiles were also judged as symmetric or asymmetric according to the levels of the corners and morphology of the lips both for the natural and the forced smile.

### *Statistical Analysis*

Chi-square test analysis was used to assess the statistical significance of differences between groups. A probability of  $p < 0.05$  was accepted to reject the null hypothesis.

## RESULTS

The sample was composed of 364 women and 212 men, aged from 21 to 78 years (mean age: 37.68 years). The gender distribution showed more females (63.19%) than males (36.81%). The main result of this study is shown in Fig. 5. Class 3 was the most frequent (44.79% for natural smile and 45.49% for forced smile). During natural smile 4.69% had a very high smile line and during forced smile 22.22% had a very high smile



Fig. 4a Class 1.



Fig. 4b Class 2.



Fig. 4c Class 3.



Fig. 4d Class 4.

line. During natural smile 42.36% had a low smile line while during forced smile 10.94% had a low smile line. The periodontium was more visible in the forced smile (Class 1+Class 2+Class 3=87.06%) than in the natural smile (Class 1+Class 2+Class 3=57.64%). The cemento-enamel junctions were revealed in the forced smile in 43.57% of the participants (Class 1+2). The frequency distribution of the study population according to age and gender during natural and forced smile is presented in Table 1. Women (66.21%) were more likely to show their periodontium (Class 1+Class 2+Class 3) than men (42.93%) during natural smile (Fig. 6). This difference was significant. During forced smile, there was no significant difference between women

(90.11%) and men (87.27%) based on the same conditions (Fig. 7). During natural smile significant differences were observed in young participants compared with the two older participant groups (Fig. 8). During natural and forced smiles, the low smile line class had the lowest percentage in the younger participant group. They revealed their gingival embrasures in 93.24% of cases (Class 1+Class 2+Class 3) and their cemento-enamel junctions in 46.96% of cases (Class 1+Class 2) during forced smile (Fig. 9). During natural smile, 21.1% of the participants presented an asymmetry compared with 17.53% of participants during forced smile. The difference was significant.

Fig. 5 Frequency distribution of the study population according to this new classification for the natural smile and the forced smile.

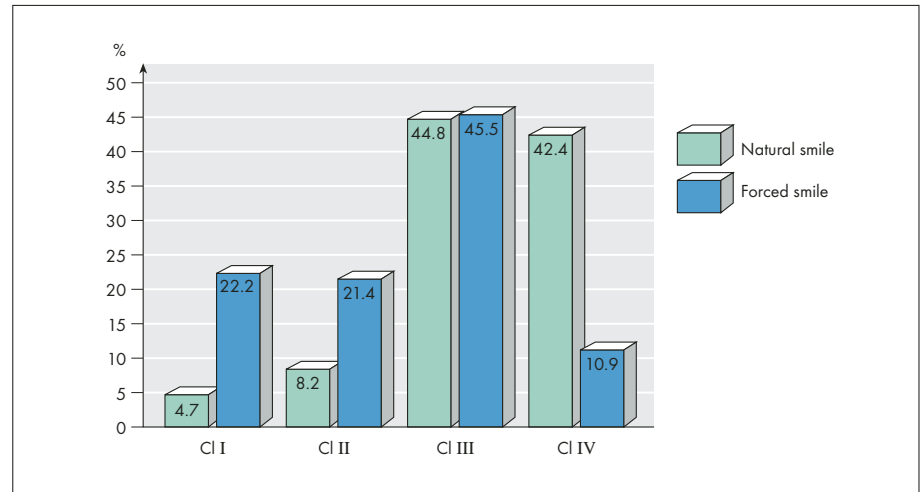


Table 1 The frequency distribution of the study population according to age, gender, natural smile and forced smile

Population	Natural smile				Forced smile				Total
	CI 1	CI 2	CI 3	CI 4	CI 1	CI 2	CI 3	CI 4	
576 Participants									
F 21–35	9	21	93	43	45	39	71	11	166
%	5.42	12.65	56.02	25.90	27.11	23.49	42.77	6.63	28.82
F 36–50	6	8	52	46	24	26	50	12	112
%	5.36	7.14	46.43	41.07	21.43	23.21	44.64	10.71	19.44
F+51	3	8	41	34	20	19	35	12	86
%	3.49	9.30	47.67	39.53	23.26	22.09	40.70	13.95	14.93
H 21–35	7	6	55	61	28	27	66	8	129
%	5.43	4.65	42.64	47.29	21.71	20.93	51.16	6.20	22.40
H 36–50	0	3	6	35	5	4	22	13	44
%	0	6.82	13.64	79.55	11.36	9.09	50.00	29.55	7.64
H+51	2	1	11	25	6	8	19	6	39
%	5.13	2.56	28.21	64.10	15.38	20.51	48.72	15.38	6.77

## DISCUSSION

Using this classification for both natural and forced smile the mean result of this study is that 89.06% of participants displayed their periodontium. This proportion is very important because this classification considered the whole papilla and the forced smile.

Gingival health and appearance are essential components of an attractive smile (Towsend, 1993; Dolt and Robbins, 1997; Morley and Eubank, 2001). If disturbed gingival contour caused by recession, altered passive eruption, or poor tooth positioning are considered to be unat-

tractive, the loss of interproximal papilla is considered to be unaesthetic (Chiche and Pinault, 1995). The loss of papilla rapidly creates visible damage that patients call 'black holes'. This new classification considered the gingival embrasure when the papilla was present or absent. The periodontium or its supposed localization was visible for participants in Class 1, Class 2 and Class 3. In this new classification the Class 3 allowed for the detection of participants whose interproximal papilla, but not the gingival margin, was exposed. Class 3 classification was important for aesthetic appearance and individual self-perception. In the present study the data showed that the

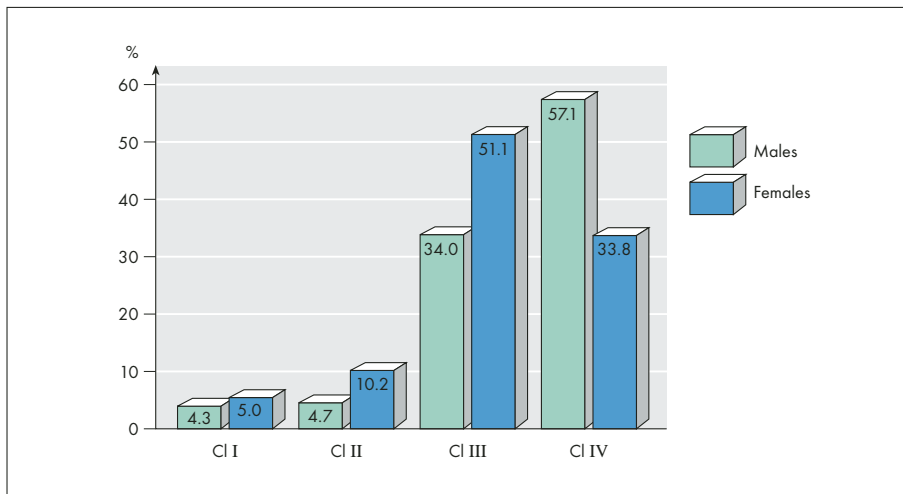


Fig. 6 Frequency distribution of the natural smile and forced smile according to this new classification for males and females during natural smile.

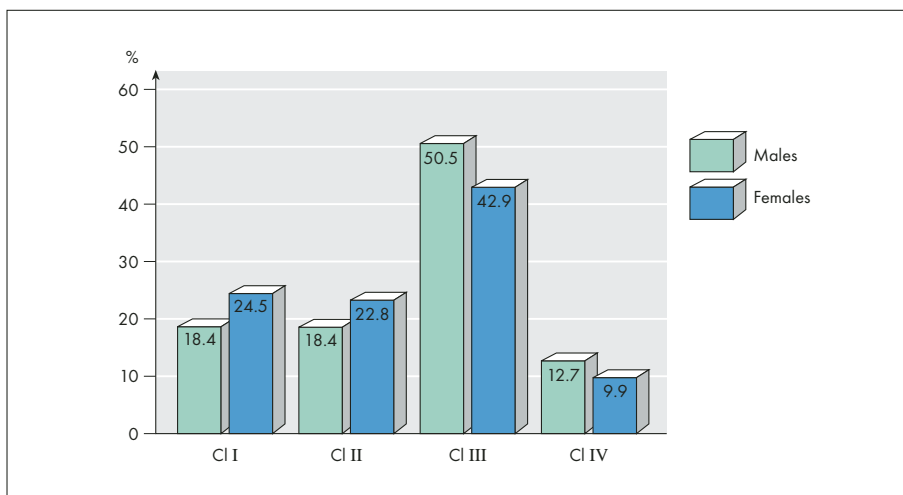


Fig. 7 Frequency distribution of the natural smile and forced smile according to this new classification for males and females during forced smile.

Class 3 was the most frequently encountered classification during natural and forced smile. There are numerous kinds of natural smiles because patients can smile in different ways based on how they are feeling. The smile can be inconspicuous with the lips closed or open. The 'dentolabial' smile is an open smile (Barat, 1987). In this smile, it is difficult to evaluate the quantity of visible teeth and periodontium. The periodontist should consider the maximal gingiva-revealing smile. In the present study, the participants were photographed during natural smile and during maximal smile (also called the forced smile). Crispin and Watson (1981) concluded that during forced smile, 84% of participants revealed

their gingival margin: this percentage was less than the one reported in the present study because they did not measure papilla visibility. Tjian et al (1984) reported that 79.5% of patients presented periodontium visibility without specifying the type of smile. Jensen et al (1999) reported that about 70% of patients revealed more than 25% of their periodontium in their usual contact smile. We cannot compare this data because we cannot know from their classification how many participants did not reveal their periodontium at all. In the present study, 89.06% of participants had visible gingival embrasures and/or marginal gingiva. There was a significant difference between forced smile (almost 90% of cases had visible gingiva) and natu-

Fig. 8 Frequency distribution according to this new classification for age groups during natural smile and forced smile according to age.

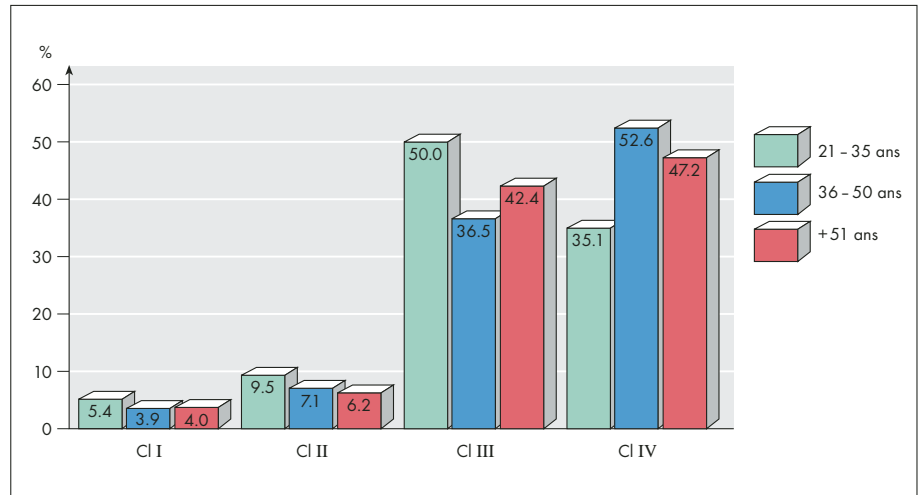
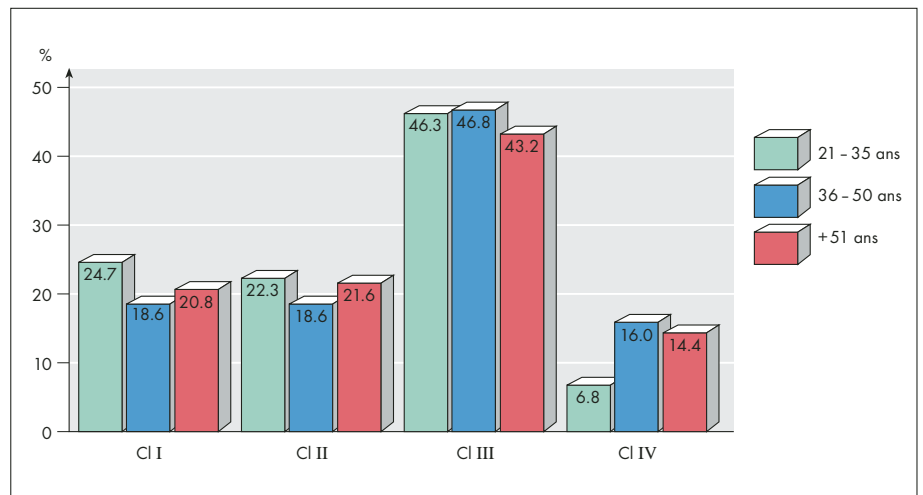


Fig. 9 Frequency distribution according to this new classification for age groups during forced smile according to age.



ral smile (about 60% only). These data prove the importance of maximal smile examination for the evaluation of gingival visibility.

Age and gender have an influence on satisfaction with oral appearance (Neumann et al, 1989). Jensen et al (1999) noted that the position of the smile line was significantly lower with age. These authors suggested that the facial height could increase with age so the upper lip might change its dimension with ageing. Their second explanation was that the elasticity of soft tissues might decrease with age owing to age-related alterations in the connective tissue metabolism, possibly resulting in 'sinking' of the facial tissues. Our study confirmed this observation for natural smile but not for forced smile.

The influence of gender has also been demonstrated by Jensen et al (1999). Women presented a higher smile line position compared to men. In the present study, women and men presented a higher smile line in the 21 to 35 years old group, but only for forced smile. During forced smile, the position of the smile line was not lower with age and women did not reveal more gingival margin than men. Age and gender did not influence the position of the smile line because of the stretching of the lips during forced smile.

More participants presented an asymmetry during natural smile than during forced smile. This asymmetry did not always disappear with the contraction of the upper lip during forced smile. Within



Fig. 10a During natural smile, a 24-year-old woman presents an average smile line for this classification.



Fig. 10b During forced smile, the same patient presents a high smile line for this classification: an attractive smile.



Fig. 10c Even though she is not revealing her marginal gingiva during forced smile, this patient complains about her dental appearance caused by generalized recessions. This is because she knows what is hidden behind her lips, and so she thinks that everyone can see “what she knows”. For this reason she requests treatment for reasons of self-perception and satisfaction.

the limits of the present study, we can conclude that periodontium was visible in 89.06% of the participants, which is a very high rate, and that the examination of periodontium visibility must also be performed during forced smile. Restorative dentists and periodontists have to pay attention to the fact that the visual impact of the smile is not associated exclusively with the beauty of individual teeth but also with the periodontium (Morley and Eubank, 2001). However, the practitioner should be careful since alterations are irreversible and can be extremely visible (Towsend, 1993). It could also be argued that aesthetic problems could also be discussed for approximately 10% of

the remaining patients, because, even if the periodontium is not visible, these patients may demand an aesthetic periodontium for psychological reasons (Figs. 10a, b, c).



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