



Analysis of soft tissue display in Chinese subjects during an enjoyment smile

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Objective: Due to global migration, clinicians often see patients with different ethnic backgrounds. Planning esthetic prosthodontic treatment for patients with different ethnicities can be a challenge. The aim of this study is to analyze the smile features of Chinese individuals. **Method and Materials:** Sixty-two Han-Chinese subjects with a mean age of 28.5 years were enrolled and photographed. Standardized digital photographs were made to measure the height of displayed maxillary gingivae, papillae, and teeth during an enjoyment smile. The data were then compared with the data acquired from Caucasians in a previous study. Statistical analysis was performed using the Mann-Whitney test and two-factorial nonparametric analysis. **Results:** The mean display of the central incisors was 10 mm, with no significant difference between sexes ($P = .74$). The mean amount of display of the molars and premolars was significantly lower in Chinese ($P < .001$) than in Caucasians. The mean displayed gingiva in all subjects ($n = 62$) was 1.3 mm (0 to 8 mm). There was no significant difference between sexes ($P > .05$), but there was a significantly lower display of gingiva at the molars in Chinese ($P < .001$). Of all the subjects, 16.1% ($n = 10$) displayed gingivae from the central incisor to the first molar with a mean gingival height of 2.8 mm. The subjects showed a mean papilla height of 3.4 mm (0 to 11.6 mm) with no significant difference between sexes ($P > .05$). Again, a significantly lower display of papilla at the molar ($P < .001$) was found in Chinese. Of all subjects, 43.5% ($n = 27$) of all subjects showed papilla from the central incisor to the first molar. The mean papilla height of these subjects was 3.9 mm. All subjects displayed at least one papilla. **Conclusion:** The results indicate that pink esthetics is a prime factor for both Chinese men and women in the esthetic restoration from the central incisors to the premolars. (*Quintessence Int* 2012;43:105–110)

Key words: denture, esthetics, lip dynamic, smile

A smile is considered a universal, friendly greeting in all cultures, and in modern society, it is regarded as one of the most

important interactive communication skills a person has.¹ An attractive smile can have a distinct impact on a person's psychosocial well-being and self-esteem.² Improving smile esthetics is often one consideration of patients seeking prosthodontic treatment. Prior to prosthodontic treatment, smile analysis is part of the esthetic evaluation.³ Smile analysis can provide information about the relationship between teeth and their surrounding soft tissue and is a key element of diagnosis and treatment planning in esthetic dentistry.^{1,3–11} Global migration in today's world has affected the distribution of ethnicities in many countries, which leads to a diversity of ethnic groups seeking dental treatment in daily clinical work.¹² The perception of esthetics is influenced by culture, ethics, and race and may vary from the

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Table 1	Distribution of the origin (province) of the Han-Chinese subjects evaluated in the study		
	Beijing	Zhejiang	Sichuan
Women (n = 30)	11	9	10
Men (n = 32)	12	13	7

standards established by the Caucasian population.^{13,14} Knowledge of racial esthetic differences can help clinicians diagnose and consider esthetic alterations during prosthodontic treatment with regard to the ethnic origin of the patient.^{13,14}

Most studies concerning smile analysis focus on mainly the display of gingiva at the anterior teeth during a social smile.^{1,4-6,8} Only a few studies report gingival display during an enjoyment smile.⁷⁻¹¹ The literature concerning smile analysis seems to pertain to only the Caucasian race,⁷⁻¹¹ with the exception of the studies from Owens et al¹³ and Zhang et al,¹⁵ which consider smile analysis in the Chinese population. However, neither study showed absolute values concerning gingival display.

A preceding study and one of the first studies evaluating the amount and frequency of soft tissue display during enjoyment smiles in Caucasians showed the importance of smile analysis for prosthetic restorations.¹¹ Therefore, it is essential to evaluate the gingiva and papilla display during enjoyment smiles in the Han-Chinese population. The aim of this study is to analyze the heights and frequencies of gingival and papillary display during enjoyment smiles in Chinese compared with Caucasians.

METHOD AND MATERIALS

The research proposal was approved by the Ethical Committee of Charité University Medicine, Berlin, Germany. Informed consent was obtained from each participant.

Participants

Sixty-two Han-Chinese (32 men, 30 women) from three major areas in China with a mean age of 28.5 years (20 to 35 years) were selected and enrolled in the study (Table 1). The data were also compared with that of 66 Caucasians (30 men, 36 women) with a mean age of 28.4 years (20 to 35 years) from a previous study.¹¹ The subjects, who had no facial disharmonies and full natural maxillary dentition without periodontal disease, caries, or prosthodontic treatment, were photographed.

Recording and measurement

The digital recording and measurement was performed as described.¹¹ The clinical crown length of the maxillary central incisors was measured and compared with the digital measurement to guarantee the reliability of this method. This standardized condition was applied for all subjects. Numerous images of each subject were taken, and the one with the maximum enjoyment smile was selected.

Each image was processed in Photoshop CS4 (Adobe). The parameters evaluated during an enjoyment smile are displayed in Fig 1.

- Tooth display: the distance from the zenith to the midpoint of the incisal or occlusal inferior edge of each tooth
- Gingival display: the distance from the zenith to the most inferior edge of the upper lip
- Papillary display: the distance from the tip of the papilla to the most inferior edge of the upper lip

If the tooth, gingiva, or papilla was not visible, the value was recorded as zero.

Statistical analysis

Descriptive analysis was performed with all data recorded. The Mann-Whitney test was applied for the detection of a difference between sexes. A two-factorial nonparametric analysis was performed to identify the difference between nationalities (Chinese and Caucasian). Significance was defined as $P < .05$. Statistical analysis was performed using SPSS 13.0 (IBM) and SAS 9.1 (SAS Institute).



Fig 1 Diagram of the measurement parameters. (a) Tooth display, (b) gingival display, and (c) papillary display during an enjoyment smile.

Table 2 The mean ± SD (mm) displayed tooth height in Chinese women and men and Caucasians						
	Central incisor	Lateral incisor	Canine	First premolar	Second premolar	First molar
Chinese women (n = 30)	9.8 ± 1.3	8.6 ± 1.0	8.6 ± 1.4	7.0 ± 1.2	4.2 ± 2.7	0.6 ± 1.8
Chinese men (n = 32)	9.6 ± 1.3	8.6 ± 1.3	9.1 ± 1.7	6.8 ± 1.7	3.0 ± 2.9	0.3 ± 1.3
Caucasians (n = 66)	9.4	8.4	8.9	7.2	5.6	2.3
<i>P</i> value	.95		< .001*		< .001*	

SD, standard deviation. The difference between the nationalities was analyzed using the two-factorial nonparametric analysis (**P* < .05 was considered significant).

Table 3 The mean ± SD (mm) displayed gingival height in Chinese women and men and Caucasians						
	Central incisor	Lateral incisor	Canine	First premolar	Second premolar	First molar
Chinese women (n = 30)	1.4 ± 1.6	2.3 ± 2.0	1.8 ± 2.0	2.1 ± 2.2	1.5 ± 1.8	0.3 ± 0.8
Chinese men (n = 32)	0.9 ± 1.6	1.6 ± 1.6	1.1 ± 1.5	1.5 ± 1.9	1.0 ± 1.6	0.1 ± 0.5
Caucasians (n = 66)	0.6	1.4	1.2	1.6	1.5	0.5
<i>P</i> value	.12		.81		< .001*	

SD, standard deviation. The difference between the nationalities was analyzed using the two-factorial nonparametric analysis (**P* < .05 was considered significant).

RESULTS

Tooth display

Chinese women show more of the central incisors, premolars, and first molars than men, but this difference is not significant (*P* = .74, .24, and .36, respectively) (Table 2).

The amount of display of premolars and molars compared with Caucasians (*P* < .001) is significantly smaller, whereas there is no difference in the amount of display of the anterior teeth (*P* = .95) (see Table 2). The

complete display of the lateral incisor and first premolar is found more frequently in Chinese than in Caucasians.

Gingival display

The mean amount of display of gingiva in all Han-Chinese subjects (n = 62) is 1.3 mm (0 to 8 mm) (Table 3). Of all subjects, 16.1% (n = 10) display gingiva from the central incisor to the first molar. The mean height of gingival display in these subjects is 2.8 mm (0.8 to 5.9 mm).





Table 4 Frequency (%) of display of soft tissue in the gingival and papillary areas in Chinese

	Central incisor	Lateral incisor	Canine	First premolar	Second premolar	First molar
Gingiva						
Women (n = 30)	97	100	97	93	65	12
Men (n = 32)	97	97	97	92	50	5
Papilla						
Women (n = 30)	100	100	100	93	65	12
Men (n = 32)	100	100	100	92	50	5

Table 5 The mean ± SD (mm) displayed papillary height in Chinese women and men and Caucasians

	Central incisor	Lateral incisor	Canine	First premolar	Second pre-molar	First molar
Chinese women (n = 30)	4.9 ± 2.5	5.2 ± 2.5	5.0 ± 2.6	4.1 ± 2.6	2.7 ± 2.7	0.5 ± 1.4
Chinese men (n = 32)	3.9 ± 2.0	4.4 ± 2.1	4.5 ± 2.2	4.0 ± 2.4	2.1 ± 2.5	0.2 ± 0.7
Caucasians (n = 66)	3.8	4.4	4.3	3.7	2.9	1.3
<i>P</i> value	.28		.58		< .001*	

SD, standard deviation. The difference between the nationalities was analyzed using the two-factorial nonparametric analysis (**P* < .05 was considered significant).

Chinese women tend to show slightly more gingiva than men (*P* = .18, .12, and .28) (see Table 3).

A comparison of the amount of displayed gingiva between Caucasians and Chinese revealed a significant difference between the ethnicities for the first molar but no significant difference for the anterior teeth and premolars (see Table 3). The frequency of the display of gingiva in Chinese is depicted in Table 4.

Papillary display

The mean amount of display of the papilla in Chinese subjects is shown in Table 5. Twenty-seven (43.5%) of the subjects show their papilla at all evaluated teeth with a mean height of 4.8 mm (2.6 to 7.5 mm). All of the subjects displayed soft tissue in the papillary area of the maxillary anterior teeth (Fig 2).

Women tend to show more papilla than men, but the difference is not significant for the anterior teeth, premolars, and first molars (*P* = .21, .59, and .19, respectively) (Table 5). Women display papilla more frequently than men (Table 4).

The comparison of the amount of papillary display between ethnicities revealed a significant difference for only the molars (Table 5).

DISCUSSION

Esthetic considerations in prosthetic restorations have become more important in patients' decisions for dental therapy. An attractive smile involves the harmonious interaction of the lips, teeth, and surrounding gingival scaffold. Lip position during a smile not only defines the type of smile but influences the clinical and technical procedures required for esthetic prosthetic restorations.^{2,16-18} Few studies have been published quantifying the display of gingiva and papilla during enjoyment smiles.⁷⁻¹⁰ It has been demonstrated that different races have distinct cephalometric norms; therefore, esthetic guidelines for prosthodontic treatment should be established that consider race.^{13,19,20} This study identified differences between Han-Chinese and





Fig 2 Variations in the amount of soft tissue display during the enjoyment smile in (a and b) women and (c and d) men. All of the subjects displayed papillae in the anterior region.

Caucasians in the frequency and amount of display of gingiva and papilla during enjoyment smiles, regardless of sex.

In Chinese, the display of the anterior teeth during enjoyment smiles is greater than in Caucasians but not statistically so.¹¹ This might be due to a greater protrusion of the teeth in Chinese.¹⁹ A higher occlusal plane angle in Chinese might be responsible for a significantly lower tendency and smaller amount of display of the gingiva in the posterior teeth.²⁰

Previous studies demonstrated that women tend to show more gingiva than men in the anterior teeth and premolars.^{8,9} This phenomenon was also observed in the present study, regardless of race. This sex difference was not evident for the molar region, since the display of the tooth as well as the soft tissue in this area was generally low in Chinese.

The interdental papilla is essential for esthetic restorations and remains a challenge for clinicians despite numerous techniques that have been described for its preservation and reformation.²¹⁻²⁴ It was reported that the papilla could enhance a

youthful appearance as a complimentary factor in age interpretation and has been considered a critical asset in denture esthetics.^{25,26} However, no data on papilla display during smiling is available for Chinese, and only one previous study shows data on papillary display in Caucasians.¹¹ The present study revealed the significance of the papilla not only in the anterior maxillary region but also for the esthetic restoration of the premolars in Chinese.

CONCLUSION

Chinese women display a slightly greater amount of gingiva and papilla and at a higher frequency compared with men, albeit without significance. Soft tissue in the area of the papilla of the anterior teeth is displayed in 100% of the participants. This indicates that pink esthetics is a paramount factor for both Chinese men and women during prosthetic restoration.





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