

# The Relationship Between Upper Lip Length and Excessive Maxillary Gingival Display in a Sample of Jordanians

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## ABSTRACT

**Objectives:** To assess the average upper lip length of a sample of Jordanian dental patients and to examine the association between upper lip length and excessive gingival display (EGD).

**Methods:** This is a comparative cross-sectional study. Adult patients between 18 and 35 years old with a chief complaint of EGD were included in the first group, while regular dental patients of the same age group were included in the control group. EGD was defined as a display of 2 mm or more of maxillary gingiva in a forced posed smile. External upper lip length was defined as the distance from the subnasale to the most inferior portion of the upper lip at the midline.

**Results:** Ninety-nine patients participated in the EGD group and 149 patients participated in the control group. The mean resting upper lip length in the EGD group was  $19.7 \pm 2.8$  mm and in the control group, it was  $21.3 \pm 2.8$  mm. Male patients had longer upper lip length compared to female patients and the difference between the two genders was statistically significant. The prevalence of EGD was 27.5%. The mean upper lip length in patients with a higher smile line was significantly shorter than patients with an average or a low smile line.

**Conclusion:** This study identified an association between short upper lip length and EGD. Listening to patients' concerns regarding EGD and involving them in the management plan are expected high-level skills of Jordanian dentists. In the end, there is nothing more rewarding for the dentists than enhancing the smile of their patients.

**Keywords:** Gummy Smile; Maxillary Central Incisor; Excessive Gingival Display; Aesthetics; The Royal Medical Services

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## BACKGROUND

Humans have long been concerned with facial aesthetics. One of the earliest descriptions of facial aesthetic features was found in ancient Egyptian culture (1–3). The smile is considered a distinct feature of the human species and it is used for greetings, expression of joy, happiness and pleasure (4–6).

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The days when patients used to seek dental care only for functional reasons are long gone (7,8). Nowadays, there is an increasing demand for dental aesthetic interventions all over the world (9–11). Meanwhile, dental scientific publications still focus on skeletal structure more than soft tissue structures (12).

Three facial anatomical structures are involved in a smile: lips, teeth and gingiva (1,13–15). Although tooth size, colour and shape are important for the aesthetic smile, lips play a major role (12,16–18). Lips and eyes are one of the first-noticed facial features (19). Several publications have linked patients' perceived self-confidence, social and personality development with an aesthetic smile (20–24). It is believed that people with an aesthetic smile have better chances of career advancement and are perceived as trustworthy (21,25). Although joy is subjective and hard to measure, the literature is full of detailed descriptions of the aesthetic smile and its distinct features (1,26–28).

In 1984, Tjan et al. classified the smile into low, average and high smile lines (25,29). The smile is considered low line when less than 75% of the maxillary incisors are displayed during a full smile. The average line smile is when there is 75-100% display of the maxillary incisors. A high smile line is described as the display of both the full maxillary incisor length and a band of contiguous maxillary gingiva (4,30).

Displaying a small amount of maxillary gingiva is considered aesthetic and a sign of youth (12). On the other hand, displaying more than 2-3 mm of maxillary gingiva is considered unpleasant and for some people, it is described as handicapping their aesthetic facial features (31,32). It has been reported that patients have requested interventions when there is a 1 mm display of maxillary gingiva (9).

The American Academy of Periodontology defines excessive gingival display (EGD) (or high smile line) as a mucogingival deformity. It is considered a symptom rather than a diagnosis. Nowadays, symptomatic treatment is gaining increasing support from maxillofacial and plastic surgeons all over the world (33). Although there is no clinical classification for EGD, the layperson would describe it as a 'gummy smile' and would seek medical attention (21).

Several aetiological factors are associated with EGD, such as gingival enlargement, vertical maxillary excess, delayed passive eruption, or a combination of factors (21,34). Another newly-identified aetiological factor is nasal septum dysplasia (33,35). The aetiology of EGD can be congenital, acquired, or iatrogenic (33,36,37). Meanwhile, there is no consensus between researchers on whether or not the short upper lip is an aetiological factor for EGD (4,38).

Management of EGD requires proper identification of the cause, with a treatment plan tailored to the cause and to patient expectations (31,34,39). Often, the treatment plan requires collaboration between different dental specialties (26,40,41). As a general rule of thumb, the management of EGD should not be aggressive because it is most likely that the condition will disappear as part of the aging process (42,43).

Most of the previous studies on EGD were conducted in Western societies, with a rare presentation of people with Middle Eastern or Arab ethnicity (16). The present study aims to assess the average lip length between two selected groups of Jordanian patients. The first is a group of patients presenting to the dental clinics of the Royal Medical Services of Jordan with a

chief complaint of EGD; the second is a control group of regular visitors to the dental clinics. The objective is to assess the association between upper lip length and EGD in addition to establishing a reference number for upper lip length of the Jordanian population.

## **METHODS**

The ethical committee of the Royal Medical Services of Jordan approved this descriptive, comparative cross-sectional study. It was carried out in accordance with the Helsinki Declaration and the Royal Medical Services' regulations to protect human research participants. After explaining the aim of the study, the authors obtained voluntary verbal consent from all participants. Adult patients between 18 and 35 years old, with a chief complaint of EGD, were included in the first group. Regular dental patients of the same age group were included in the control group. Exclusion criteria for both groups were a history of previous maxillofacial surgery or trauma, congenital facial anomalies, observed asymmetry in the maxillary or mandibular areas, loss of one or more of the anterior maxillary or mandibular teeth and patients with a history of neurological disorders.

Patients were examined in a dental chair and were requested to keep their head and back in an upright position. The first author examined each patient in a resting position during a forced posed smile.

EGD was defined as a display of 2 mm or more of maxillary gingiva in a forced posed smile (9,38). External upper lip length was defined as the distance from the subnasale to the most inferior portion of the upper lip at the midline (12). Resting left maxillary central incisor display was defined as the distance from the most inferior portion of the upper lip to the incisal edge of the incisor (4). All measurements were conducted using a calibrated electronic digital calliper. In addition to these measurements and observations, the gender and age of each patient were recorded. Data were collected between May and July 2020 at the dental clinics of King Hussein Medical Center (KHMC), Amman, Jordan.

Data were first recorded on paper forms, then entered into an Excel sheet (Microsoft Corp., Redmond, WA, USA), where they were reviewed and amended. Missing data and data entry errors were corrected by cross-checking with the original paper forms. The data were analysed using Statistical Package for the Social Sciences (SPSS) (IBM Corp., version 25.0, USA). Student's t-test and one-way ANOVA were used to compare means. The chi-square ( $\chi^2$ ) test was used to examine the relationship between categorical study variables. A p-value of < 0.05 was considered statistically significant.

## **RESULTS**

Ninety-nine patients participated in the EGD group and 149 patients in the control group. The mean age of the control group was  $23.6 \pm 4.3$  years and 56.4% were female. The majority of patients in the EGD group were female (63.6%). Demographics of study participants are described in Table I.

**Table I** Characteristics of study participants

Variable	EGD group (n=99)		Control group (n=149)		
	Mean	SD	Mean	SD	
Age (years)	21.5	3.8	23.6	4.3	
Gender	n	%	n	%	
	Male	36	36.4	65	43.6
	Female	63	63.6	84	56.4

\* Significant at  $\alpha < 0.05$  level

The mean resting upper lip length in the EGD group was  $19.7 \pm 2.8$  mm, while in the control group it was  $21.3 \pm 2.8$  mm. This difference was statistically significant ( $t(210.8) = -4.5$ ,  $p < 0.001$ ). In addition, the maxillary central incisor display was longer in the EGD group and this difference was statistically significant ( $t(173.1) = 7.2$ ,  $p < 0.001$ ). The shortest mean upper lip length was observed in female patients in the EGD group ( $19.1 \pm 2.5$  mm) and the longest mean upper lip length was observed in male patients in the control group ( $22.2 \pm 2.9$  mm) (Table II and Table III).

The average upper lip length was  $21.3 \pm 2.8$  mm. However, this average was sexually dimorphic. Male patients had longer upper lip length than female patients (in the control group) and the difference in average lip length was statistically significant ( $t(126.9) = 3.3$ ,  $p < 0.001$ ) (

**Table IV**). No significant correlation was identified between age and upper lip length (Pearson Correlation = -0.032,  $p = 0.698$ ).

The overall prevalence of high smile line (EGD) in the control group was 27.5% (Table V). EGD prevalence was higher among female patients (32.1%) than male patients (21.5%), but this was not statistically significant ( $\chi^2(2) = 2.196$ ,  $p = 0.333$ ).

Patients with a high smile line (the control group) had a mean upper lip length of  $20.3 \pm 2.6$  mm. The mean upper lip length in patients with higher smile line was shorter than in patients with an average or a low smile line. The difference in mean upper lip length between the three groups of smile line was statistically significant ( $F(2, 146) = 4.771$ ,  $p = 0.010$ ) (Table VI).

**Table II** Differences between study groups in mean upper lip length and maxillary central incisor display (mm)

Variable	EGD group (n=99)		Control group (n=149)		Independent t-test		
	Mean	SD	Mean	SD	t	df	p-value
Resting upper lip length	19.7	2.8	21.3	2.8	-4.5	210.8	< 0.001*
Maxillary central incisor display	4.6	2.1	2.8	1.6	7.2	173.1	< 0.001*

\* Significant at  $\alpha < 0.05$  level

**Table III** Differences between study groups in mean upper lip length and maxillary central incisor display (mm) according to gender

Variable	EGD group (n=99)				Control group (n=149)			
	Male		Female		Male		Female	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Resting upper lip length	20.8	2.9	19.1	2.5	22.2	2.9	20.7	2.5
Maxillary central incisor display	4.1	1.9	4.8	2.1	2.5	1.7	3.1	1.4

**Table IV** Differences between genders of the control group (n=149) in mean upper lip length and maxillary central incisor display (mm)

Variable	Male (n=65)		Female (n=84)		Independent t-test		
	Mean	SD	Mean	SD	t	df	p-value
Resting upper lip length	22.2	2.9	20.7	2.5	3.3	126.9	0.001*
Maxillary central incisor display	2.5	1.7	3.1	1.4	-2.4	122.7	0.016*

\* Significant at  $\alpha < 0.05$  level

**Table V.** Smile type by gender in the control group (n=149)

Variable	Male (n=65)		Female (n=84)		Chi-squared test		
	n	%	n	%	Pearson $\chi^2$	df	p-value
Low smile	15	23.1	15	17.9	2.196	2	0.333
Average smile	36	55.4	42	50.0			
High smile	14	21.5	27	32.1			

**Table VI** Resting upper lip length (mm) by smile type in the control group (n=149)

Variable	n	Mean	SD	One-way ANOVA test					
				Sum of Squares	df	Mean Square	F	p-value	
Low smile	30	22.1	2.7	Between Groups	69.9	2	34.9	4.771	0.010*
Average smile	78	21.6	2.8	Within Groups	1068.7	146	7.3		
High smile	41	20.3	2.6	Total	1138.5	148			

\* Significant at  $\alpha < 0.05$  level

## DISCUSSION

Previous studies have estimated that the prevalence of EGD is between 11% and 29% (34,36,44,45). The overall prevalence of a high smile line in the current study (27.5%) was within these parameters. In 2010, Al-Jabrah et al. reported a very similar prevalence of EGD in a sample of Jordanian patients (22.1%) (30). However, previous studies reported a higher prevalence in Pakistan (38%) and Malaysia (39%) (16,25). These differences could be explained by variation in study methodology, ethnicity and age groups of the participants.

The average upper lip length in Jordanian men ( $22.2 \pm 2.9$  mm) and women ( $20.7 \pm 2.5$  mm) (Table II) was similar to reported averages for the same age group in other populations (33,46,47).

The main objective of the current study was to examine the relationship between upper lip length and EGD. Based on current study results, patients with shorter upper lip length are statistically more prone to EGD ( $p = 0.010$ ).

The findings of this study are contrary to those of Peck et al., Jasim Al-Juboori et al. and Sethna et al., who reported that there was no significant association between upper lip length and EGD in American, Malaysian and Indian communities. It is possible that ethnic differences could explain these results (25,38,48,49). However, the current study was not the first to observe the association between upper lip length and EGD. In 2012, Miron et al. reported a similar association between these two variables (4).

The association between gender and high smile line has been well-documented (42,50). Some researchers have started to describe EGD as a female feature (32,51). Al-Habahbeh et al. and Al-Jabrah et al. reported in two previous studies in Jordan that female patients had more maxillary gingival display than male patients (30,52). It is possible that the current study failed to identify an association between gender and EGD because of under-representation of male patients in the control group (Table V). However, the association between gender and mean upper lip length was statistically significant (

### Table IV).

Drummond and Capelli reported that age has a significant effect on EGD (42). The length of the upper lip tends to increase with age (especially in male patients), which decreases EGD (1,52,53). Meanwhile, the excessive mandibular gingival display tends to increase with age because of lower lip drop (12,54). Patients in the present study were young adults between 18 and 35 years old. This limited age range might have led to a lack of significant association between age and upper lip length.

Management of EGD depends on several factors, such as patient age, gender, expectations and aetiology of EGD (33,55,56). The choices of possible intervention range from reversible minimal invasive botulinum toxin injections to invasive orthognathic surgery (36,51,57). Several treatment modalities described in the literature show high patient satisfaction rates (9,31,36,58).

Ser Yun et al. classified the management of gummy smile into palliative, corrective or adjunctive management modules (33). Recent articles have shown a rapid advancement in these management modules (7,31,34,59).

Due to the cross-sectional nature of this study, causality between upper lip length and EGD could not be assessed. The convenience sample methodology could also be considered a limitation. However, the sample size could be considered relatively large, which could increase the precision of study parameters. To the best of our knowledge, this was the first study to establish a reference description for the upper lip length in the Jordanian population and it is one of the first studies in the Middle East to examine the association between upper lip length and EGD.

## CONCLUSION

In conclusion, there is an association between short upper lip length and EGD. Patients with EGD had significantly shorter upper lip length compared with the control group. The results of this study could help dentists in Jordan and in the region to identify and manage cases of EGD.

There is a need for further studies to describe the best EGD management algorithms and to measure the effects of EGD on patient perceptions of an aesthetic smile. Developing accurate identification tools for the cause of EGD and the use of new technologies could guide the management plan and achieve better patient satisfaction results (31,33,60).

Listening to patients' concerns regarding EGD and involving them in the management plan are expected high-level skills of Jordanian dentists. In the end, there is nothing more rewarding for the dentists than enhancing the smile of their valuable patients.

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