



MDJ

## **The correlation between upper lip length, amount of free way space and visible portion of anterior teeth at rest position.**

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### **Abstract**

The aims of this study were to investigate the degree of visibility of maxillary and mandibular anterior teeth surfaces when the lips are at rest. And to evaluate its correlation with age and sex. As well as to determine the correlation of the upper lip length with the amount of clinical free way space.

Two hundred adults (100 males and 100 females) were examined. All the subjects had maxillary and mandibular anterior teeth present with bilateral molar support. The measurement was taken at the midpoint of the each anterior tooth when the lips and lower jaw were at rest position. The length of upper lip was measured from the base of the columella to the tip of the philtrum at the midline of the face. Artificial landmarks (adhesive tape) were placed on the more prominent parts of the nose and chin of each subject. The clinical free way space value was obtained by subtracting measured vertical dimension of occlusion from postural vertical dimension.

Females showed more of the maxillary central and lateral incisors than males. With increasing age, the amount of maxillary anterior teeth that was visible at rest position decreased. Statistically the amount of visible surface of maxillary central incisor showed significant differences with increasing age of subjects. The subjects with shorter upper lips displayed more of maxillary central and lateral incisors than those with longer upper lips. Significant differences were founded between the visible amount of maxillary central and lateral incisors and lip length. It was founded that the more increased in the length of upper lip, the more decreased in the vertical dimension as increased in the amount of clinical free way space which is founded within the recommended range (2-4mm). High significant differences were founded between the amount of clinical free way space and length of upper lip. Females showed shorter upper lip than males and high significant differences were founded between sexes and upper lip length.

### **Introduction**

In the absence of pre-extraction records, investigators have used various methods to aid in the selection and placement of artificial teeth for complete dentures. Natural tooth position and size provide the dentist with an optimal guide<sup>(1)</sup>. Several guide lines were suggested to establish the

lip length-incisal edge relationship and, accordingly, the visible amount of anterior teeth<sup>(2), (3)</sup>.

Many prosthodontic techniques require that the maxillary occlusion rim be contoured and adjusted to determine the proposed length of the maxillary incisor<sup>(4)</sup>. Ellinger and

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associates <sup>(5)</sup> suggest that with a normal lip the occlusion rim extend just below the resting lip with variations for short or long lips.

The amount of visible anterior teeth, with lip at rest or during function, is an important esthetic factor in determining the outcome of fixed and removable prosthodontic care, implant dentistry, operative dentistry, anterior esthetic procedures, and orthognathic surgery <sup>(6),(7)</sup>.

Also, the visible amount of anterior teeth can be one of the helpful guidelines for determining the appropriate vertical dimension of occlusion <sup>(8)</sup>.

The incisal edge position at rest is the first critical step in the esthetic evaluation and may be related to sex, lip length and age. The more tooth exposure at rest, the more youthful appearing <sup>(9)</sup>. With the lips at rest, females display more maxillary central incisors than males. In addition, individuals with shorter upper lips display more maxillary central incisor surface than people with longer upper lips, and those with longer upper lip show more mandibular central incisors <sup>(4)</sup>.

The purpose of this study was to determine the degree of visibility of maxillary and mandibular anterior teeth when the lips are at rest, and to evaluate it is correlation with age and sex. And also to investigate the correlation of the upper lip length with the amount of clinical free way space measurements.

## Material and methods

Two Hundreds adult subjects (100 males and 100 females) were randomly selected from dental clinic of the College of Dentistry, Baghdad University. The ages of the subjects ranged from 20 to 60 years. All the subjects had maxillary and mandibular

anterior teeth without caries, restorations, appreciable attrition, mobility, extrusion, or obvious deformities, Subjects with a history of congenital anomalies, lip trauma, facial surgery, or orthodontic treatment were excluded. All subjects were with bilateral molar support.

Measurements were made by using electronic digital caliper to the nearest tenth of a millimeter. The portions of anterior teeth that were visible were measured vertically from the lip to the incisal edge for the right incisors, and to the cusp tip, for the right canines, at the mid point of the tooth when the lips and lower jaw were at the rest position (Figure 1). The measurement was considered to be zero if the tooth could not be seen regardless of how short it was. Three measurements per tooth were made and the mean was calculated. The length of the upper lip was measured from the base of the columella to the tip of the philtrum at the midline of the face (Figure 2).

Artificial landmarks (adhesive tape) were placed on the more prominent parts of the nose and chin of each subject. Vertical dimension of occlusion was measured in the intercuspal position (figure 3). Postural vertical dimension was measured after swallowing saliva and in a relaxed postural mandibular position (figure 4). Then, the clinical free way space values was obtained by subtracting vertical dimension of occlusion from postural vertical dimension. All recorded data were statistically analyzed by t-test, ANOVA and Chi-square.

## Results

There are non significant differences in the visible amount of teeth with lips at rest were between the sexes. The males displayed more of the maxillary canine and mandibular

anterior teeth than the females. On the other hand, females showed more of the maxillary central and lateral incisors than males with average visible amounts of  $2.75 \pm 1.45$ mm and  $2.29 \pm 1.33$ mm, for central incisors, respectively, and  $1.53 \pm 0.86$ mm and  $1.39 \pm 0.81$  for lateral incisors, respectively (Table 1).

(Table 2) shows the difference in the visible amount of teeth between the age groups. With increasing age, the amount of maxillary anterior teeth that was visible at rest decreased and the opposite was true for the mandibular anterior teeth. Among the anterior teeth, the amount of visible maxillary central incisor was most significantly affected by aging.

Subjects with shorter upper lips displayed more maxillary anterior incisors structure than subjects with longer upper lips. The amounts of visible maxillary central and lateral incisors were significantly affected by the length of the upper lip (Table 3).

The mean amount of clinical free way space was increased with increasing the length of the upper lip. There is a high significant difference for the means of clinical free way space regarding the length of upper lips (Table 4), and there is a non significant difference was found for the means of upper lip length.

Females show high percentage of short upper lip than males 67.1% and 32.9%, respectively. While males had high percentage of medium upper lip than females 57.5% and 42.5% respectively. As well as for long upper lip length 77.8% and 22.2% respectively (Figure 5). Chi-square test reveal a high significant differences between sexes regarding the length of upper lips at  $P < 0.01$ .

## Discussion

The mean visible amount of maxillary central incisor for males was  $2.29 \pm 1.33$ mm and for females was  $2.75 \pm 1.45$ mm. In Misch<sup>(10)</sup>, the measurements were 2.5mm and 3.8mm, respectively. For Vig and Brundo<sup>(4)</sup>, the measurements were 1.91mm and 3.40mm, respectively; while Al Wazzan<sup>(6)</sup> reported the visible amount of maxillary central incisor to be  $2.66 \pm 1.50$ mm for males and  $2.91 \pm 1.89$ mm for females. Connor and Moshiri<sup>(11)</sup> reported the visible amount of maxillary central incisor to be  $1.82 \pm 2.8$ mm for white males and  $2.09 \pm 2.27$ mm for white females. The variations may be due to differences in measuring techniques, genetic factors and differences between the populations studied.

There are non significant differences in the amounts of anterior teeth exposure with lips at rest was founded between sexes (Table 1). Regarding the maxillary central incisor, the result was in agreement with Al Wazzan<sup>(6)</sup> result. While the other results regarding the maxillary lateral and canine and mandibular anterior teeth in contrary to other studies<sup>(6),(11)</sup> The present study showing more of the maxillary canine, and mandibular anterior teeth when the lips are at rest is associated with the males and it can be considered as a masculine feature, while prominent maxillary central and lateral incisors are associated with the females and this is can be due to that the thicker and firmer skin of male restricts the mobility of the lips, especially that of the upper lip. This is the reason why, as a rule, men show much less of their upper teeth when speaking and laughing than do women<sup>(12)</sup>.

Data presented in (Table 2) showed that the amount of the maxillary central incisor exposed when the lips were at rest decreased from 3.46mm at age 20-30 to 1.67mm at age 51-60. The

opposite occurs for the mandibular central incisor, with approximately 0.97mm showing at age 20-30 and 1.39mm at age 51-60. Statistical analysis showed a significant difference between the visible amount of maxillary central incisor and the age of population sample which was in agreement with other study<sup>(6)</sup>.

With the increasing age, the amount of the visible length of maxillary anterior teeth decreases and the amount of mandibular anterior teeth that is visible increases when the lips were at rest position. This finding is in agreement with the finding reported by Al Wazzan<sup>(6)</sup> and Vig and Brundo<sup>(4)</sup>. It is obvious from this study that as time and gravity wins out, tissues surrounding the mouth sag.

It is clear from these results that during treating patient for complete denture and during adjusting the vertical length of the occlusion rims in the anterior region using the same therapeutic values regardless of age differences is not acceptable since it contributes greatly to the obvious "denture look"<sup>(4)</sup>.

From (Table 3) we can see that people with short upper lips display more maxillary central and lateral incisors, while people with long upper lips display more mandibular anterior teeth and maxillary canine. This finding is in agreement with Al Wazzan results<sup>(6)</sup>, as well as for maxillary and mandibular central incisors is in agreement with Vig and Brundo findings<sup>(4)</sup>.

Statistically the differences between groups and upper lip lengths were not significantly differences which were in agreement with other study<sup>(6)</sup> regarding lower anterior teeth. While for maxillary anterior teeth the results were statistically in contrast to other study<sup>(6)</sup>, which were significant differences for maxillary central and lateral incisors and non significant

difference for maxillary canine. This is may be due to differences in sample populations.

The results of this study and other studies<sup>(4),(6)</sup> showed the maxillary central incisor is the most prominent tooth in the mouth; accordingly, extra care should be taken when selecting its size, form, and positioning.

Vig and Brund<sup>(4)</sup> and Al Wazzan<sup>(6)</sup> as well as the present study had suggested guidelines for the arrangement of anterior teeth should be based upon the amount of tooth exposure when the lips are at rest. Although these guidelines are not absolute, they do provide helpful hints for enhancing the esthetic appearance of the dentures.

In order to create a pleasing esthetic result, the degree of tooth visibility should not be considered separately from other esthetic determinates for the degree of visibility of tooth structure must be in harmony with contours, size, incisal edges, occlusal plane, lip line, smile line, and the location of the midline. The vertical positioning of maxillary anterior teeth can not be established by the visible amount of tooth a lone, because they also play an important role in both anterior guidance and phonetics<sup>(6)</sup>.

(Table 4) shows high significant differences between the means of clinical free way space and the lengths of upper lip. While there are a non significant differences were founded for means of upper lip length. From this study the mean measurements of free way space in dentate subjects were within the recommended 2-4mm range, however few percent of the subjects in this study had free way space measurements outside this range. This result is in agreement with other study<sup>(13)</sup>.

The results of this study showed the more increased in the length of upper

lip, the more decreased in the vertical dimension as increased in the amount of free way space and this is result is in agreement with other study<sup>(14)</sup>. This result can be used as an aid in arriving at an acceptable vertical dimension and pleasing esthetic result during construction of complete or partial dentures. Extreme prominence of the upper ridge in patients who have had recent extractions or advanced resorption of the upper ridge in other patients may affect these determinations but reliance on good judgment in these exceptional conditions as well as the more average ones will assure a reasonable amount of success.

It was found that males shows high percentage of long and medium upper lip while female shows high percentage of short upper lip (Figure 5), this can be considered as a feminine feature, as well as this also explains why prominent maxillary central incisors are associated with the females. It was founded a high significant differences between males and females regarding upper lip length.

## Conclusion

A survey has been presented that correlates measurements of upper lip length, sex, and age with amount of exposure of maxillary and mandibular anterior teeth with the lips in the resting position as well as the correlation with amount of clinical free way space. Perhaps the most interesting findings were:

- Females showed more of maxillary central and lateral incisors than males. While males showed more of maxillary canine and mandibular anterior teeth.
- With increasing age, the amount of maxillary anterior teeth that was visible at rest decreased. On contrast the amount of mandibular anterior

teeth increased. It provides an excellent starting point for vertical positioning anterior teeth that can be modified as necessary in a clinical situation.

- The subjects with shorter upper lips displayed more of maxillary central and lateral incisors structure than those with longer upper lips. The amount of visible portions of anterior teeth is determined by muscle positions that vary from person to another.
- The more increased the vertical dimension (decreased in the amount of free way space which associated with decreased in the length of upper lips), the more display of the maxillary and mandibular teeth, because teeth are moved to occupy more of the interocclusal space.
- Females showed more of short upper lip while medium and long upper lips are associated more with males.

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Table (1) Mean amount of visible tooth surface according to sex (mm)

Sex	No.	Maxillary central incisor	Maxillary lateral incisor	Maxillary canine	Mandibular central incisor	Mandibular Lateral incisor	Mandibular canine
Male	100	2.29±1.33	1.39±0.81	0.65±0.50	1.24±0.49	1.16±0.52	1.01±0.63
Female	100	2.75±1.45	1.53±0.86	0.31±0.35	1.16±0.59	1.10±0.53	0.92±0.52
<b>t-test</b>		0.316	0.162	0.971	0.175	0.113	0.173
<b>p-value</b>		P>0.05	P>0.05	P>0.05	P>0.05	P>0.05	P>0.05
<b>Sig.</b>		NS	NS	NS	NS	NS	NS

± = Standard deviation.

Table (2) Mean amount of visible tooth surface according to age.

Age	No.	Maxillary central incisor	Maxillary lateral incisor	Maxillary canine	Mandibular central incisor	Mandibular Lateral incisor	Mandibular canine
20-30	50	3.46±1.69	1.93±0.96	0.51±0.53	0.97±0.62	0.94±0.50	0.85±0.61
31-40	50	2.75±1.05	1.61±0.77	0.49±0.40	1.14±0.49	1.04±0.48	0.92±0.49
41-50	50	2.18±1.13	1.25±0.70	0.47±0.44	1.29±0.38	1.21±0.43	0.98±0.58
51-60	50	1.67±0.85	1.06±0.53	0.45±0.33	1.39±0.58	1.35±0.58	1.12±0.63
<b>F-test</b>		7.29	1.92	0.800	1.38	1.36	0.44
<b>P-value</b>		0.011	0.081	0.106	0.110	0.076	0.170
<b>Sig.</b>		S	NS	NS	NS	NS	NS

± = Standard deviation.

Table (3) Mean amount of visible tooth surface according to Upper Lip length (mm).

Upper Lip Length	No %	Maxillary central incisor	Maxillary lateral incisor	Maxillary canine	Mandibula -r central incisor	Mandibula -r Lateral incisor	Mandibula -r canine
10-15.5	76	2.97±1.43	1.71±0.86	0.36±0.37	0.99±0.57	0.92±0.50	0.68±0.48
15.51-20.50	106	2.34±1.35	1.38±0.79	0.52±0.48	1.27±0.43	1.21±0.42	1.10±0.54
20.51-25	18	1.71±0.98	0.91±0.49	0.81±0.42	1.68±0.49	1.62±0.47	1.39±0.66
<b>F-test</b>		3.99	5.07	0.01	0.12	0.10	0.07
<b>P-value</b>		0.017	0.015	0.94	0.766	0.786	0.813
<b>Sig.</b>		S	S	NS	NS	NS	NS

± = Standard deviation.

Table (4) Mean amount of clinical free way space in relation to Upper Lip length (mm).

Upper Lip Length	No (%)	Mean of Upper Lip Length	Mean amount of clinical free way space
10-15.50	76(38%)	14.49±0.95	2.34±0.70
15.51-20.50	106(53%)	17.89±1.28	3.33±0.85
20.51-25	18(9%)	21.87±0.80	4.29±0.48

F=0.10 p=0.91 P>0.05 NS (For means of upper lip length).

F=44.8 p=0.00 P>0.01 HS (For means of clinical free way space).

± = Standard deviation.

**Figures:**

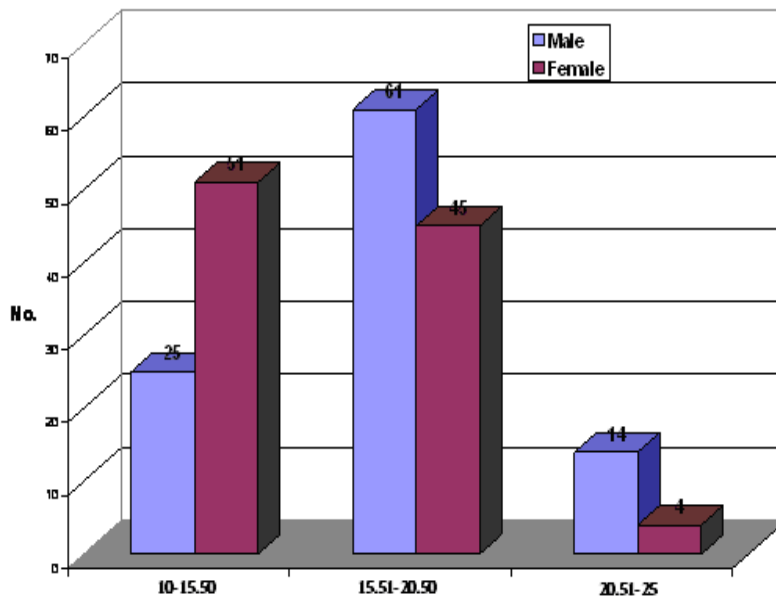


Figure 5. Frequency of upper lip length according to sex.

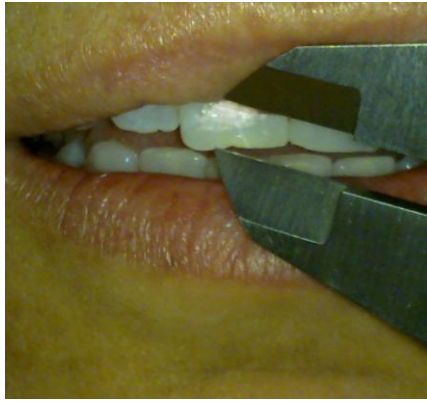


Figure 1. Measuring the visible portion of maxillary central incisor.

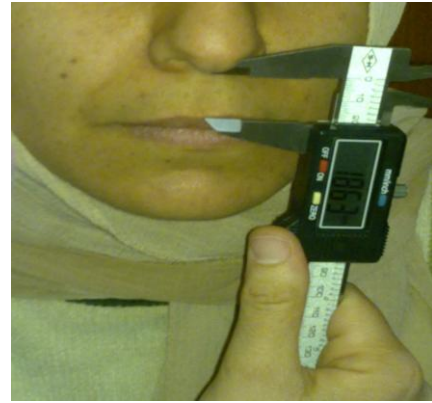


Figure 2. Measuring the length of upper lip.



Figure 3. Measuring the vertical dimension of occlusion.



Figure 4. Measuring the vertical dimension at rest position.