



A Comparative Evaluation of Effect of Upper Lip Length, Age and Sex on Amount of Exposure of Maxillary Anterior Teeth

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ABSTRACT

Aim: The aim was to evaluate the relationship of age, sex and lip length to the amount of exposure of maxillary incisors and canine teeth.

Materials and methods: Two-hundred subjects were enrolled in the study. All subjects were grouped according to the lip length and age. The exposure of maxillary central incisor and canines was measured with flexible millimeter ruler. Teeth exposure beyond the lower border of the upper lip was considered as positive exposure and the unexposed teeth were considered as negative exposure.

Result: In females of age group 20 to 29, 30 to 39, 40 to 49 and 50 to 59 years, the mean exposure of central incisor was 2.16, 2.1, 2.18 mm and that of canine was 0.04, -0.36, -0.44 mm. For male of age group 20 to 29, 30 to 39, 40 to 49 and 50 to 59 years exposed 2.04, 2.04, 1.84, 1.76 mm of central incisor respectively and 0.08, -0.52, -0.4 and -0.4 mm exposure of canine. Female subjects with lip length 10 to 15, 15 to 20, 21 to 25, 25 to 30 and 31 to 35 mm showed 3.7, 3.4, 2.3, 0.9, 0.25 mm exposure of central incisor and 0.35, -0.15, -0.7, -0.8, -0.6 mm exposure of canine, respectively. Male subjects exposed 3.4, 3.3, 2.05, 0.7, 0.15 mm of central incisor and 0.4, 0.3, -0.6, -0.95, -0.7 mm of canine respective to lip length.

Conclusion: The range of exposure of maxillary central incisors was wider than that of canine. The average dimensions for maxillary canines relating to age and sex were closer to the extremes of the range. The canine position relative to the maxillary lip appeared to be a more predictable determinant.

Clinical significance: The result of the study can be used as a reference according to the age, sex and the lip length of the patient to correctly place maxillary anterior teeth in prosthesis.

Keywords: Lip length, Maxillary teeth exposure.

How to cite this article: Patel JR, Prajapati P, Sethuraman R YG N. A Comparative Evaluation of Effect of Upper Lip Length Age and Sex on Amount of Exposure of Maxillary Anterior Teeth. *J Contemp Dent Pract* 2011;12(1):24-29.

Source of support: Nil

Conflict of interest: None declared

INTRODUCTION

The ideal goal of restorative dentistry, especially prosthetic dentistry, is to restore occlusion, esthetics, phonetics, function, form and contour of stomatognathic system. Anterior teeth play very important role in esthetics, phonetics and incision of the food. When restoring the anterior teeth, esthetics is primary focus by dentist as well as by the patients.

When a patient is missing all the maxillary anterior teeth, the prosthodontist should attempt to position the artificial teeth in the position that the natural teeth were arranged in or in a fashion similar to the arrangement of ideal patient of similar age, gender, race and facial structure.

Phonetics guidelines are often used to determine the position of the maxillary incisors in fabrication of maxillary complete dentures. Position of maxillary anterior teeth can be evaluated by using the words 'Z', 'S', 'F' and 'V'. As a general rule, the vertical position of central incisors is often placed about 2 mm below the vermilion border of the upper lip. But the position of the teeth can be influenced by age, sex and length of the upper lip.

Frush JP and Fisher RD¹ stated that the 'smiling line' helped to determine the vertical position of the maxillary teeth in complete denture. They observed that the central incisors were longer than the other maxillary teeth, and the curvature of the maxillary teeth follows the curvature of the upper border of the lower lip during smiling. Boucher CO² observed that the vertical positions of the maxillary anterior teeth were determined by phonetics, especially with labiodental sounds. He noted that maxillary central and lateral incisors touched the lower lip during pronunciation of the letters 'F' and 'V'. He also noted the relationship exposure of anterior teeth when the lip is at rest. Payne SH³ used phonetics to determine the position of the maxillary

anterior teeth using the words 'S', 'Z' and 'C'. He reported that if the vertical position of the maxillary teeth was too low, the teeth would 'click' tighter. Relationship of age, sex, race and lip length on exposure of maxillary teeth was first evaluated by Vig RG, Brundo GC⁴. Sharry JJ⁵, Elinger CW⁶, Landa SL⁷ observed that the occlusal aspect of the maxillary occlusal rim should extend approximately 1 to 2 mm below upper lip in repose.

According to Misch CE,⁵ vertical position of the maxillary anterior teeth and the lip in repose should be determined by the maxillary canine position. No range or average dimension of the maxillary anterior teeth exposure was reported by Misch, relative to the lip in repose.

Heartwell CM⁶ evaluated the correlation between lip length and teeth exposure and reported that the vertical positions of the central incisors were primarily determined by their relationship with the lip in repose regardless of the age and sex. Misch CE⁷ found that the relationship in exposure of the cusp tip of maxillary canine to the maxillary lip in repose position exhibited a narrow range.

The purpose of this study is to evaluate the relationship between the vertical position of the maxillary central incisal edge and the maxillary canine relative to the maxillary lip line in repose of dentate patients and to evaluate the relationship of age, sex and lip length to the amount of exposure of maxillary incisors and canine teeth.

MATERIALS AND METHODS

One hundred male and 100 female patients were enrolled in this study from the OPD of Department of Prosthodontics, Crown and Bridge and Oral Implantology of KM Shah Dental College and Hospital, Piparia, Gujarat. All 200 patients had at least first molar occlusions. Patients were not included in the study, who were edentulous completely or partially, especially in maxillary anterior region, having history of orthodontic movement of the maxillary anterior teeth and severe tooth wear of maxillary anterior teeth. Patients having history of plastic surgery, restoration or prosthesis of maxillary anterior teeth and protrusive maxilla were not included in the study.

The selected subjects were informed about the study and written consent was taken and subjects were grouped as follows:

Group 1M: Twenty-five male patients within age range 20 to 29 years

Group 1F: Twenty-five female patients within age range 20 to 29 years

Group 2M: Twenty-five male patients within age range 30 to 39 years

Group 2F: Twenty-five female patients within age range 30 to 39 years

Group 3M: Twenty-five male patients within age range 40 to 49 years

Group 3F: Twenty-five female patients within age range 40 to 49 years

Group 4M: Twenty-five male patients within age range 50 to 59 years

Group 4F: Twenty-five female patients within age range 50 to 59 years.

Each group patients irrespective of age and sex again divided, according to the lip length as follows:

- Very short lip length—10 to 15 mm
- Short lip length—16 to 20 mm
- Average lip length—21 to 25 mm
- Long lip length—26 to 30 mm
- Very long lip length—31 to 36 mm.

All measurements were made by the same examiner. Patients were instructed to seat upright in a dental chair with their head unsupported. Each patient was instructed to say word 'emma' and relax his/her lip and lower jaw.

A flexible millimeter ruler was used to measure the vertical distance from vermilion border of the maxillary lip in repose to the maxillary right central incisor (Figs 1 and 2). The similar procedure was used to measure the position of the left central incisor and left and right maxillary canines.

The data obtained from these measurements were separated according to the age, sex and lip length of maxillary lip. The age brackets used for this study were 20 to 29 years, 30 to 39 years, 40 to 49 years and 50 to 59 years.

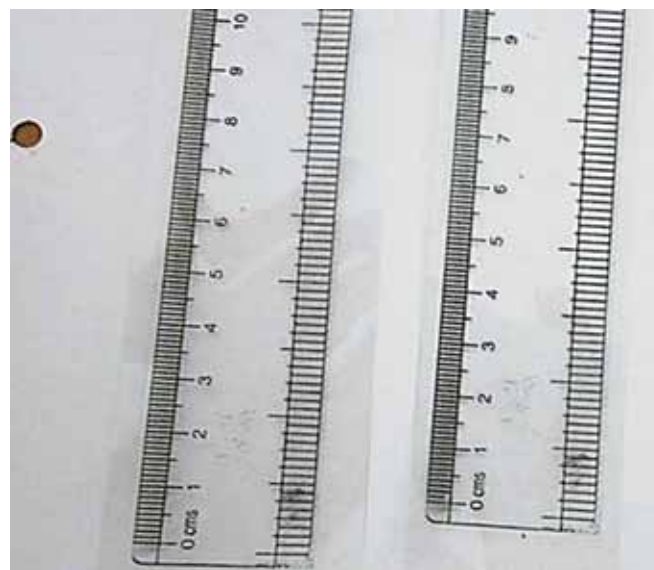


Fig. 1: Flexible millimeter rulers used to measure the exposure of maxillary central incisors and canines



Fig. 2: Measurement of exposure of maxillary central incisor using flexible millimeter ruler

The maxillary lip length brackets used in the study were very short lip length (10 to 15 mm), short lip length (16 to 20 mm), average lip length (21 to 25 mm), long lip length (26 to 30 mm) and very long lip length (31 to 36 mm).

RESULTS

Data were collected and mean values were obtained for male and female for each age group. For female subjects of age group 20 to 29 years, the mean exposure of right and left central incisor is 2.16 mm and right and left canine exposure was 0.04 mm. The range of exposure of central incisor for this group is 0.2 to 4 mm and range of exposure for canine was -0.6 to 1 mm. For female subject of age group 30 to 39 years the exposure of central incisor was 2.1 mm with range of exposure 0.2 to 3.8 mm and canine exposure was -0.36 mm with exposure range from -0.8 to 1 mm. Subjects with age group 40 to 49 years showed mean exposure of 2.18 mm for central incisor and -0.44 for canine with range 0.2 to 3.6 mm for incisor and -0.8 to 0.2 mm for canine.

The exposure of central incisor and canine for age group was 2.08 and -0.76 mm, respectively. With range of exposure 0.4 to 3.4 mm for central incisor and -0.8 to -1 mm for canine (Table 1).

For male subjects within age 20 to 29 years showed 2.04 mm exposure of central incisor with range 0.2 to 3.6 mm and 0.08 mm exposure of canine exposure with range of -0.8 to 1.2 mm and male with age group 30 to 39 years had mean central incisor exposure of 2.04 mm with range 0.2 to 3.4 mm and mean canine exposure of -0.52 mm with range -0.6 to 1 mm.

The male subjects with age group 40 to 49 years showed mean central incisor exposure of 1.84 mm with range 0.2 to 3.2 mm and mean canine exposure was -0.4 mm with range of exposure of -1.2 to 0.4 mm.

Table 1: Mean exposure—female subjects (according to age group)				
<i>Mean exposure: Female subjects age group 20 to 29 years</i>				
<i>Lip length (mm)</i>	<i>Incisor right</i>	<i>Incisor left</i>	<i>Canine right</i>	<i>Canine left</i>
10-15	4	4	1	1
16-20	3.6	3.6	1	1
21-25	2	2	-0.4	-0.4
26-30	1	1	-0.8	-0.8
31-35	0.2	0.2	-0.6	-0.6
<i>Mean</i>	2.16	2.16	0.04	0.04
<i>Mean exposure: Female subjects age group 30 to 39 years</i>				
<i>Lip length (mm)</i>	<i>Incisor right</i>	<i>Incisor left</i>	<i>Canine right</i>	<i>Canine left</i>
10-15	3.8	3.8	1	1
16-20	3.5	3.5	-0.6	-0.6
21-25	2.2	2.2	-0.8	-0.8
26-30	0.8	0.8	-0.6	-0.6
31-35	0.2	0.2	-0.8	-0.8
<i>Mean</i>	2.1	2.1	-0.36	-0.36
<i>Mean exposure: Female subjects age group 40 to 49 years</i>				
<i>Lip length (mm)</i>	<i>Incisor right</i>	<i>Incisor left</i>	<i>Canine right</i>	<i>Canine left</i>
10-15	3.6	3.6	0.2	0.2
16-20	3.5	3.5	-0.4	-0.4
21-25	2.6	2.6	-0.8	-0.8
26-30	1	1	-0.8	-0.8
31-35	0.2	0.2	-0.4	-0.4
<i>Mean</i>	2.18	2.18	-0.44	-0.44
<i>Mean exposure: Female subjects age group 50 to 59 years</i>				
<i>Lip length (mm)</i>	<i>Incisor right</i>	<i>Incisor left</i>	<i>Canine right</i>	<i>Canine left</i>
10-15	3.4	3.4	-0.8	-0.8
16-20	3.4	3.4	-0.6	-0.6
21-25	2.4	2.4	-0.8	-0.8
26-30	0.8	0.8	-1	-1
31-35	0.4	0.4	-0.6	-0.6
<i>Mean</i>	2.08	2.08	-0.76	-0.76

The male subjects with 50 to 59 years of age group had mean exposure of 1.76 mm for central incisor and -0.4 mm for canine. The range of exposure was 0 to 3.4 mm for central incisor and -0.8 to 1 mm for canine (Table 2).

The mean exposure of central incisor and canine according to lip length was also done, the data were divided according to the lip length and mean was calculated.

Female with lip length of 10 to 15 mm showed 4, 3.6, 3.6 and 3.4 mm exposure of central incisor and canine exposure of 1 mm, 1 mm, 0.2 mm and -0.8 mm for age group 20 to 29 years, 30 to 39 years, 40 to 49 years and 50 to 59 years respectively.

For female with 16 to 20 mm lip length, the mean exposure for incisor and canine was 3.5 mm and -0.15 mm, respectively. They showed 3.6, 3.5, 3.5, 3.4 mm of exposure for age group 20 to 29 years, 30 to 39 years, 40 to 49 years and 50 to 59 years, respectively and 1, -0.6, -0.4,

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Table 2: Mean exposure—male subjects (according to age group)

Mean exposure: Male subjects age group 20 to 29 years				
Lip length (mm)	Incisor right	Incisor left	Canine right	Canine left
10-15	3.6	3.6	0.8	0.8
16-20	3.4	3.4	1.2	1.2
21-25	2.2	2.2	-0.4	-0.4
26-30	0.8	0.8	-0.8	-0.8
31-35	0.2	0.2	-0.4	-0.4
Mean	2.04	2.04	0.08	0.08
Mean exposure: Male subjects age group 30 to 39 years				
Lip length (mm)	Incisor right	Incisor left	Canine right	Canine left
10-15	3.4	3.4	1	1
16-20	3.4	3.4	-0.6	-0.6
21-25	2	2	-1	-1
26-30	1.2	1.2	-1	-1
31-35	0.2	0.2	-1	-1
Mean	2.04	2.04	-0.52	-0.52
Mean exposure: Male subjects age group 40 to 49 years				
Lip length (mm)	Incisor right	Incisor left	Canine right	Canine left
10-15	3.2	3.2	0.4	0.4
16-20	3.2	3.2	-0.4	-0.4
21-25	2	2	-0.2	-0.2
26-30	0.6	0.6	-1.2	-1.2
31-35	0.2	0.2	-0.6	-0.6
Mean	1.84	1.84	-0.4	-0.4
Mean exposure: Male subjects age group 50 to 59 years				
Lip length (mm)	Incisor right	Incisor left	Canine right	Canine left
10-15	3.4	3.4	-0.6	-0.6
16-20	3.2	3.2	1	1
21-25	2	2	-0.8	-0.8
26-30	0.2	0.2	-0.8	-0.8
31-35	0	0	-0.8	-0.8
Mean	1.76	1.76	-0.4	-0.4

-0.6 mm of exposure for age group 20 to 29 years, 30 to 39 years, 40 to 49 years and 50 to 59 years respectively. Females with 21 to 25 mm of lip length had exposure of 2, 2.2, 2.6, 2.4 mm for incisor and -0.4, -0.8, -0.8 and -0.8 mm of exposure for age group 20 to 29 years, 30 to 39 years, 40 to 49 years and 50 to 59 years, respectively. The average exposure for central incisor was 2.3 and -0.7 mm for canine. Female with 26 to 30 mm lip length showed incisor exposure of 1, 0.8, 1, 0.8 mm and canine exposure of -0.8, -0.6, -0.8 and -1 mm of exposure for age group 20 to 29 years, 30 to 39 years, 40 to 49 years and 50 to 59 years, respectively. The mean for incisor exposure was 0.9 and -0.8 mm for female with lip length 26 to 30 mm. Female with lip length 31 to 35 mm had mean exposure of 0.25 and -0.6 mm for incisor and canine. They had 0.2, 0.2, 0.2 and 0.4 mm exposure for incisor and -0.6, -0.8, -0.4 and -0.6

mm exposure of canine for age group 20 to 29 years, 30 to 39 years, 40 to 49 years and 50 to 59 years respectively (Table 3).

Male with lip length 10 to 15 mm has incisor exposure of 3.6, 3.4, 3.2 and 3.4 mm and canine exposure of 0.8, 1, 0.4 and -0.6 mm for age group 20 to 29 years, 30 to 39 years, 40 to 49 years and 50 to 59 years, respectively. Male with 16 to 20 mm lip length has incisor exposure of 3.4, 3.4, 3.2 and 3.2 mm and canine exposure 1.2, -0.6, -0.4 and 1 mm for age group 20 to 29 years, 30 to 39 years, 40 to 49 years and 50 to 59 years, respectively. They had mean exposure of 3.3 mm for incisor and 0.3 mm for canine. Male

Table 3: Mean exposure—female subjects (according to lip length)

Female subjects with lip length 10-15 mm				
Age group (years)	Incisor right	Incisor left	Canine right	Canine left
20-29	4	4	1	1
30-39	3.8	3.8	1	1
40-49	3.6	3.6	0.2	0.2
50-59	3.4	3.4	-0.8	-0.8
Mean	3.7	3.7	0.35	0.35
Female subjects—lip length 16-20 mm				
Age group (years)	Incisor right	Incisor left	Canine right	Canine left
20-29	3.6	3.6	1	1
30-39	3.5	3.5	-0.6	-0.6
40-49	3.5	3.5	-0.4	-0.4
50-59	3.4	3.4	-0.6	-0.6
Mean	3.5	3.5	-0.15	-0.15
Female subjects—lip length 21-25 mm				
Age group (years)	Incisor right	Incisor left	Canine right	Canine left
20-29	2	2	-0.4	-0.4
30-39	2.2	2.2	-0.8	-0.8
40-49	2.6	2.6	-0.8	-0.8
50-59	2.4	2.4	-0.8	-0.8
Mean	2.3	2.3	-0.7	-0.7
Female subjects—lip length 26-30 mm				
Age group (years)	Incisor right	Incisor left	Canine right	Canine left
20-29	1	1	-0.8	-0.8
30-39	0.8	0.8	-0.6	-0.6
40-49	1	1	-0.8	-0.8
50-59	0.8	0.8	-1	-1
Mean	0.9	0.9	-0.8	-0.8
Female subjects—lip length 31-35 mm				
Age group (years)	Incisor right	Incisor left	Canine right	Canine left
20-29	0.2	0.2	-0.6	-0.6
30-39	0.2	0.2	-0.8	-0.8
40-49	0.2	0.2	-0.4	-0.4
50-59	0.4	0.4	-0.6	-0.6
Mean	0.25	0.25	-0.6	-0.6

subjects with 21 to 25 mm lip length had 2.2, 2, 2 and 2 mm exposure for incisor and -0.4, -1, -0.2 and -0.8 mm exposure for canine for age group 20 to 29 years, 30 to 39 years, 40 to 49 years and 50 to 59 years respectively. Male subjects of this group had mean exposure of 2.05 and -0.6 mm for incisor and canine. Male with lip length 26 to 30 mm had incisor exposure of 0.8, 1.2, 0.6 and 0.2 mm and canine exposure of -0.8, -1, -1.2 and -0.8 mm for age group 20 to 29 years, 30 to 39 years, 40 to 49 years and 50 to 59 years respectively. They had average exposure of 0.7 and -0.95 mm for incisor and canine. The males with 31 to 35 mm exposed 0.2, 0.2, 0.2 and 0.0 mm of incisor and -0.4, -1, -0.6 and -0.8 mm of canine for age group 20 to

29 years, 30 to 39 years, 40 to 49 years and 50 to 59 years respectively. They had mean exposure of 0.15 and -0.7 mm for incisor and canine (Table 4).

In this study, conducted on 100 female, the lip length and average exposure of maxillary anterior teeth are tabulated in Table 5. The overall average central incisor exposure with lip in repose was 2.13 mm and range was 0.0 to 4.0 mm and canine exposure was -0.38 mm with range -2 to 2 mm (Table 6).

Table 4: Mean exposure—male subjects (according to lip length)

Male subjects—lip length 10-15 mm				
Age group (years)	Incisor right	Incisor left	Canine right	Canine left
20-29	3.6	3.6	0.8	0.8
30-39	3.4	3.4	1	1
40-49	3.2	3.2	0.4	0.4
50-59	3.4	3.4	-0.6	-0.6
Mean	3.4	3.4	0.4	0.4
Male subjects—lip length 16-20 mm				
Age group (years)	Incisor right	Incisor left	Canine right	Canine left
20-29	3.4	3.4	1.2	1.2
30-39	3.4	3.4	-0.6	-0.6
40-49	3.2	3.2	-0.4	-0.4
50-59	3.2	3.2	1	1
Mean	3.3	3.3	0.3	0.3
Male subjects—lip length 21-25 mm				
Age group (years)	Incisor right	Incisor left	Canine right	Canine left
20-29	2.2	2.2	-0.4	-0.4
30-39	2	2	-1	-1
40-49	2	2	-0.2	-0.2
50-59	2	2	-0.8	-0.8
Mean	2.05	2.05	-0.6	-0.6
Male subjects—lip length 26-30 mm				
Age group (years)	Incisor right	Incisor left	Canine right	Canine left
20-29	0.8	0.8	-0.8	-0.8
30-39	1.2	1.2	-1	-1
40-49	0.6	0.6	-1.2	-1.2
50-59	0.2	0.2	-0.8	-0.8
Mean	0.7	0.7	-0.95	-0.95
Male subjects—lip length 31-35 mm				
Age group (years)	Incisor right	Incisor left	Canine right	Canine left
20-29	0.2	0.2	-0.4	-0.4
30-39	0.2	0.2	-1	-1
40-49	0.2	0.2	-0.6	-0.6
50-59	0	0	-0.8	-0.8
Mean	0.15	0.15	-0.7	-0.7

Table 5: Relationship of lip length and average exposure

Female subjects (exposure in mm)				
Lip length (mm)	Incisor right	Incisor left	Canine right	Canine left
10-15	3.7	3.7	0.35	0.35
16-20	3.5	3.5	-0.15	-0.15
21-25	2.3	2.3	-0.7	-0.7
26-30	0.9	0.9	-0.8	-0.8
31-35	0.25	0.25	-0.6	-0.6
Mean	2.13	2.13	-0.38	-0.38
Male subjects (exposure in mm)				
Lip length (mm)	Incisor right	Incisor left	Canine right	Canine left
10-15	3.4	3.4	0.4	0.4
16-20	3.3	3.3	0.3	0.3
21-25	2.05	2.05	-0.6	-0.6
26-30	0.7	0.7	-0.95	-0.95
31-35	0.15	0.15	-0.7	-0.7
Mean	1.92	1.92	-0.31	-0.31

Table 6: Mean maxillary teeth exposure of female and male

Sex	Incisor right (mm)	Incisor left (mm)	Canine right (mm)	Canine left (mm)
Female	2.13	2.13	-0.38	-0.38
Male	1.92	1.92	-0.31	-0.31

The 100 males enrolled in the study showed overall average exposure of 1.92 mm for central incisor with range 0.0 to 5.0 mm and canine exposure of -0.31 mm with range 2 to 2 mm (Table 6).

DISCUSSION

The determination of vertical position of the maxillary anterior teeth is an important criterion in patients missing these teeth. One of the goals in prosthetics is to replace these teeth in position similar to dentate patients of the same gender, age, race and facial structure.

In this study, the range of exposure of central incisor was wider (0.0 to 5.0 mm) than that of the canine (-2 to 2 mm). It was also observed that canine position varied lesser compared with central incisor position in accordance with sex or age. This means the canine exposure when lip is in

repose is more consistent in all age group compared with central incisor exposure.

A flexible millimeter ruler was used to measure the exposure of central incisor and canine when lip was in repose. If hard metal or plastic ruler was used, it could distort the lip while measuring the exposure. The photographs or other methods or means would not allow the measurement when the teeth are not exposed (negative measurement). The limited sample size and method to assess the canine and central incisor position suggest further study before a broad generalization of the result. A broad study with equal number of sample in each age group and lip length bracket should be used to get more reliable result.

CONCLUSIONS

The conclusions of this study are as follows:

1. In the present study, the range of exposure of maxillary central incisors was wider and the use of an average value as a guide may not be accurate for all the cases in clinical practice.
2. In this study, it was also found that the amount of exposure of the cusp tip of maxillary canine was narrower in range.
3. The average dimensions for maxillary canines relating to age and sex were closer to the extremes of the range.
4. For the patient population enrolled in this study, the canine position relative to the maxillary lip appeared to be a more predictable determinant for establishing the vertical position of the maxillary anterior teeth.
5. Study shows that more exposure of teeth in female patients compared with male.
6. Teeth exposure decreases as age progresses, it also revealed that tooth exposure decreases as lip length increases in respect of age and sex.

CLINICAL SIGNIFICANCE

The consequences of incorrectly positioning the maxillary central incisors in relation to the maxillary lip line include both obvious esthetic consequences and other more subtle problems, including improper plane of occlusion, occlusal vertical dimension, occlusal scheme during mandibular excursion and moment forces applied on the anterior teeth, denture or implant.

A consequence of improper central incisor edge position may be that the entire vertical position of the maxillary occlusal plane may be affected.

The result of the present study can be used as a reference according to the age, sex and the lip length of the patient to correctly place maxillary anterior teeth in complete denture, removable and fixed partial denture and in implant supported prosthesis. The study result can be helpful in final outcome of full mouth rehabilitation cases with great improvement in esthetic with correct exposure of maxillary anterior teeth.

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