

EVALUATION OF UPPER LIP LENGTH AND THICKNESS CHANGES ON SMILING IN PATIENTS WITH CLASS I, CLASS II DIVISION 1 AND CLASS II DIVISION 2 MALOCCLUSIONS.

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ABSTRACT

Background: The objective of this study was to evaluate the upper lip length and upper lip thickness changes in Angles class I, class II division 1 and division 2 malocclusions. **Methods:** A sample of 90 subjects was selected randomly and video equipment was used to capture video (5-10 second). The subjects were divided into three groups according to Angle's classification of malocclusion. Each group was further subdivided by gender (15 males, 15 females). Two frames were selected for each subject. One frame represents the lips at rest and the second frame represents the natural unstrained posed smile. The data for the subjects were analyzed by using one-way analysis of variance (ANOVA) with the Bonferroni post-hoc test. **Results:** In both males and females, changes in upper lip length and thickness at rest and smile was higher in class I compared with class II division 1 and class II division 2. In males, upper lip length and thickness at rest and at smile was higher in class II division 2 compared to class II division 1. In females, upper lip length and thickness at rest and at smile was higher in class II division 1 compared to class II division 2. Changes in upper lip length and upper lip thickness at rest and on smiling were greater in males as compared with females in all groups. **Conclusions:** Results from this study indicate that changes in upper lip length and thickness on smiling are affected by malocclusion and these changes differ between males and females.

INTRODUCTION

The primary objective of seeking orthodontic treatment is to improve dental esthetics.^[1] Modern orthodontic treatment requires a shift away from Angle's paradigm of achieving ideal occlusion to the more esthetically focused soft tissue paradigm.^[2] Although ideal occlusion should certainly remain the primary functional goal of orthodontics, the esthetic outcome is also critical for patient satisfaction and therefore essential to the overall treatment objectives.^[1]

The esthetic considerations are paramount in treatment planning; however, rigid rules cannot be applied to this process because almost an infinite variety of faces could be esthetic. Smile is one of the most important facial expressions and is essential in expressing emotions. A pleasing smile involves a harmonious relationship among the teeth, the gingival scaffold, and the lip framework. While considering the importance of physical and facial attractiveness, smile plays a major role.^[3-5] The aim of

modern orthodontics is to improve the quality of life which, in part, is achieved through the enhancement of the patients' smile and facial appearance. Oral health related quality of life has been defined as 'the absence of negative impacts of oral conditions on social life and a positive sense of dentofacial self-confidence.'^[6] Apart from the various factors that influence the smile there are differences in facial movements, related malocclusion and smile behavior between males and females.^[7]

Majority of orthodontic treatment diagnosis and planning is based on analyzing patient's profile, static photographs and lateral cephalogram. These records aid in adequate diagnostic information but it failed to record the smile visualization and quantification.^[2,8] In modern times smile has been given utmost importance irrespective of mode of treatment. Dynamic smile visualization and quantification can be accomplished by digital videography. Videography allows us to capture standardized/reproducible smile, thus minimizing the

error when studying one snapshot. Digital video and computer technology enables the clinician to record anterior tooth display during speech and smiling at the equivalent of 30 frames per second.^[2] The videos are recorded in standardized fashion with the camera at a fixed distance from the subject. With this method, researchers can identify a more standardized smile (greatest width), thus minimizing the inherent error of a single snapshot.^[8] The present study is carried out to determine the malocclusion and gender related changes in the upper lip length and upper lip thickness.

MATERIALS AND METHODS

Participants

The present study was conducted on 90 subjects randomly selected from Kamineni Institute of Dental Sciences, Narketpally, Nalgonda (Dist). It was explained to the subjects that this was a study on lip movements involving a (5- 10 second) video clip capturing only a small part of the face (chin to nose). Videographic records of these 90 subjects, who willingly consented to participate in the study, were taken to study the perioral zone at rest and on smiling and two frames were captured using video editing software at rest and at smile. The subjects were divided into three groups, namely, group 1 (class I), group 2 (class II division1), group 3 (class II division2), with each group containing 15 males and 15 females.

Inclusion criteria

- Age range between 18 and 25 years.
- No past or active orthodontic treatment

Selection Criteria for the Class-II Sample

Class II division 1: Bilateral Class II molar and canine relation with convex facial profile. (The skeletal classification was not considerable)

- Proclination of maxillary front teeth with an overjet of >4 mm.

Class II division 2: Bilateral Class II molar and canine relation. (The skeletal classification was not considerable)

Exclusion criteria

- Missing tooth visible on smiling
- Prosthodontics /Restorative work on tooth/ teeth visible on smiling
- Gross facial asymmetry
- Visible periodontal disease, caries, excessive dental attrition
- History of orthodontic treatment
- Lip irregularities, or history of lip surgery.

Smile Recording and Measurements

The subjects were explained that this was a study on smile involving a 5 to 10 second video clip of a small part of the face. An informed consent was obtained from each subject who agreed to participate in the study voluntarily.

A video camera (CANON 70 D) was set on the tripod 4 feet from the subject. The subjects were seated on the adjustable stool and instructed to hold the head in natural head position by looking straight into an imaginary mirror. If head position required correction, the examiner helped the subject into natural head orientation. The camera lens was adjusted to be parallel to the apparent occlusal plane and the camera focused only on the mouth (from nose to chin) so that the person could not be identified. The capture area (frame) included 2 rulers with millimeter markings. The rulers were secured in a cross configuration so that if the subject accidentally rotated 1 ruler, the other could be used to analyze the frame. The relaxed lip position was achieved by asking the subject to lick the lips and then swallow. Then, the subjects were instructed to say "Subject number ___" and then smile. Recording began 1 second before the subjects started speaking and ended after the smile.

The video clip was downloaded to a computer and uploaded to VSDC video editing software program (version 6.3.1, vector LLC). Each frame was analyzed, and 2 frames were captured for the study. Each frame was then analyzed, and finally two frames were selected for the study. The first frame represented the subjects' lips at rest or relaxed lip position, and the second frame represented the subjects' natural unstrained posed smile. The widest commissure to commissure posed smile frame was selected as one of the 10 or more frames showing an identical smile. Thus, the selected smile image represented a sustained and hence repeatable smile position.

Measurements on Rest Frame (Figure 1)

1. Upper lip length- from subnasale to stomion superius
2. Upper lip thickness- vertical distance from the most superior point of cupid's bow to the most inferior portion of the tubercle of the upper lip

Measurements on Smile Frame (Figure 2)

1. Upper lip length- subnasale to stomion superius.
2. Upper lip thickness- vertical distance from the most superior point of cupid's bow to the most inferior portion of the tubercle of the upper lip.

STATISTICAL ANALYSIS

SPSS VERSION 23 was used to perform the statistical analysis. Groups were compared by two-factor (class of malocclusion and sex) analysis of variance (ANOVA) using general linear models. If the ANOVA showed statistical significance, the Bonferroni post hoc test was done to determine which groups were significant from the others.

RESULTS

At rest position, in males, the Class I subjects possessed higher values of upper lip length followed by Class II division 1 then Class II division 2. There was no significant difference seen between the groups. In females, the Class I subjects possessed higher values of

upper lip length followed by Class II division 1 then Class II division2. This difference was significant between class II division 1 and class II division 2 and non-significant between class I, class II division1 and class I, class II division 2. (Tables 1, 2).

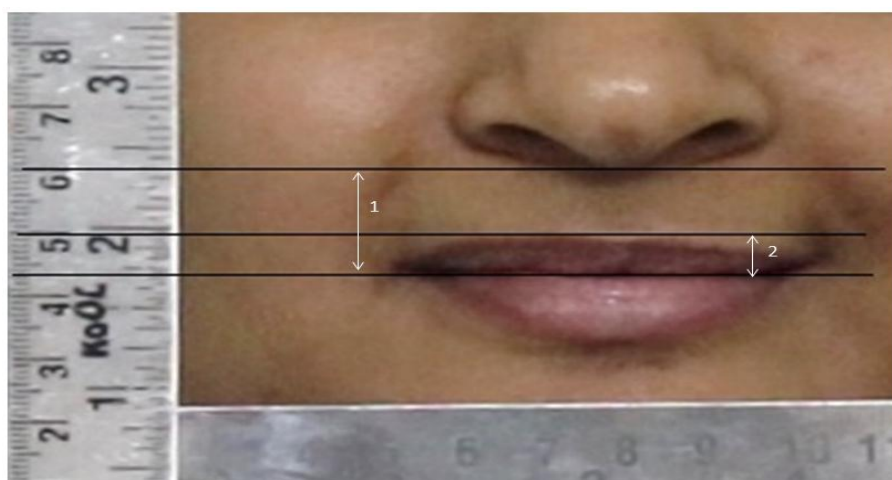
At smile position, in males Class I subjects possessed higher values of upper lip length followed by Class II division 1 then Class II division 2, this difference was non-significant between all groups. In females, Class I subjects possessed higher values of upper lip length followed by Class II division1 then Class II division2 and there was no significant difference seen between the groups (Table 3, 4). The upper lip length was higher in males compared with females in all groups at both rest and smile positions.

At rest position in males, the Class I subjects possessed higher values of upper lip thickness followed by Class II division 2 then Class II division1. This difference was significant ($P < .05$) between Class I, class II division2,

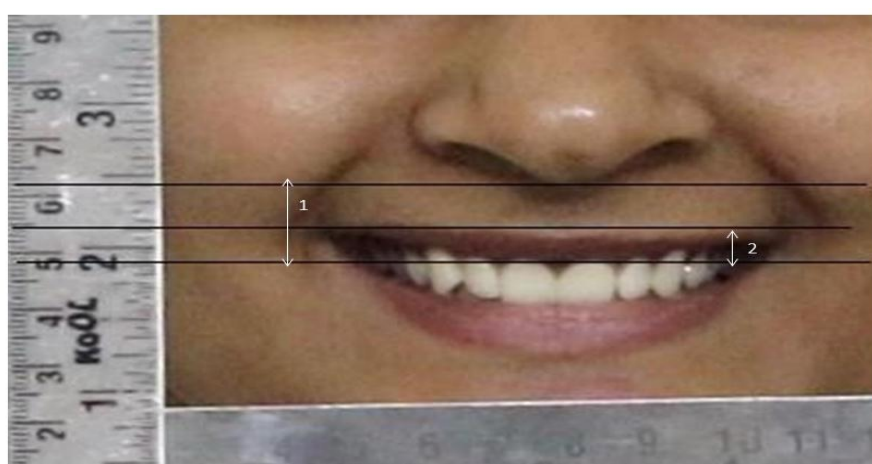
and class II division1, class II division2 and non-significant between class I and class II division1. In females, class II division 2 subjects at rest position possessed higher values of upper lip thickness followed by Class I then Class II division1. This difference was significant ($P < .05$) between Class I, class II division2 and class II division1, class II division2 and non-significant between class I, class II division1. (Tables 1, 2).

At smile position, in males Class I subjects possessed higher values of upper lip thickness followed by Class II division 2 then Class II division 1 and there was no significant difference seen among the groups ($P > .05$). In females, the Class II division 2 subjects possessed higher values of upper lip thickness followed by Class I then Class II division1 and this difference was not significant ($P > .05$) between all groups (Tables 3, 4). There was no significant difference between males and females in all groups at both rest and smile positions.

FIGURE LEGENDS



1.Measurement of upper lip length and thickness at rest position



2. Measurement of upper lip length and thickness during smile

TABLES

Table 1: Descriptive statistics of rest position measurements between males and females.

		Males	Females
Upper lip length	Group 1	20.5+1.98	17.95+1.98
	Group 2	19.8+2.04	17.6+2.0
	Group 3	19.05+1.98	16.4+1.53
Upper lip thickness	Group 1	8.8+1.54	7.9+1.37
	Group 2	7.55+1.23	6.95+0.99
	Group 3	8.6+1.09	8.0+0.79

Table 2: Comparison of rest position measurements between the groups within males and females.

Comparison	Upper lip length		Upper lip thickness	
	Males	Females	Males	Females
Group 1 vs 2	0.82	1.00	1.00	1.00
Group 1 vs 3	0.07	0.13	0.01	0.02
Group 2 vs 3	0.72	0.03	0.04	0.01

Table 3: Descriptive statistics of smile measurements between males and females.

		Males	Females
Upper lip length	Group 1	15.65 +1.27	13.65+1.84
	Group 2	15.35+1.87	12.95+1.57
	Group 3	14.8+1.70	12.7+1.78
Upper lip thickness	Group 1	7.6+1.39	6.3+0.98
	Group 2	6.80+1.28	6.15+0.81
	Group 3	7.35+0.93	6.8+0.95

Table 4: Comparison of smile measurements between the groups within males and females.

Comparison	Upper lip length		Upper lip thickness	
	Males	Females	Males	Females
Group 1 vs 2	1.00	0.26	1.00	0.27
Group 1 vs 3	0.31	0.62	0.47	1.00
Group 2 vs 3	0.87	1.00	0.12	0.08

DISCUSSION

Smile plays an important part in orthodontic diagnosis and treatment planning. This has been recognized since the beginning of the specialty, and in the current esthetically oriented society, it seems to play a central part in self-perception and social image.

The selection of the two frames used in this study was based on the reproducibility of the two expressions. Several studies^[20, 21, 22] have concluded that the rest position of the lips and posed smile are the reproducible expressions. An important aspect to consider when evaluating smile is the effect of age on smile. Based on clinical experience, the prosthetic literature demonstrates that with age, the elasticity of the lips decreases. As a result of this, older people have been reported to show less of the maxillary and more of the mandibular teeth during smiling. Dong *et al.*^[23] and Dickens *et al.*^[24] Changes in the smile as an effect of age. Both studies reported a decrease of maxillary incisor display during smiling.

Another important aspect to consider is gender differences in smile. Otta^[25] also found that females smile more expansively and more often than males do. Johnston *et al.*^[21] reported that females reproduced a maximal smile more accurately and postulated that it was due to their more frequent use of such expression. It could thus be that females use the expression more frequently than males and therefore have a wider smile. Frush and Fisher^[26] stated that the qualities of femininity and masculinity are important factors in the interpretation of smile. Rigsbee *et al.*^[27] studied changes in orofacial soft tissue after the movement from repose to smiling and found that women exhibited a greater degree of facial animation than men did. Peck *et al.*^[14] confirmed the smile line dimorphism between males and females and stated that at maximum smile, the upper lip line relative to the gingival margin of maxillary central incisors was positioned 1.5mm more superiorly in females than in males. An important aspect to consider when evaluating smile is the effect of malocclusion and gender on changes of upper lip length and thickness.

The study showed that upper lip length at rest position in class I was higher compared with other groups that come

in accordance with Rakosi^[28] who mentioned that Class II have shorter upper lip than that of Class I subjects. The upper lip length at smile position in class II division 1 was higher compared with class II division 2 and this may be due to lack of lips' elasticity in patients with class II of malocclusion, this result comes in agreement with Islam *et al*^[29] who mentioned that both the upper and lower lips in the smile of patients in the Class II division 1 group were positioned downward. Change in upper lip length in class II division 1 and division 2 was less than class I, and this result was consistent with the idea that protrusion of upper incisors in class II cases causes decreasing of the lips' elasticity and the muscles' ability to raise the upper lip. According to Islam *et al*^[29] the upward movement of the upper lip in Class II division 1 group was smaller in comparison with the class I group.

The present study showed a significant difference between class II division 1 and class II division 2 in upper lip thickness and in change of upper lip thickness. This result comes in agreement with Tanić *et al*^[30] who mentioned that the upper lip thickness was higher in class II division 2 compared with class II division 1. From the present study for overall sample, Class I and II division 1 and division 2, a significant sex difference had been seen for upper lip length with males' possessed higher value at 0.05 level of probability. Al-T'aani^[31] stated that Hellman found that the upper lip length shows significant difference between two sexes. The vertical changes in upper lip length and thickness were significantly higher in males compared with females; these results come in agreement with Chetan *et al*^[32] who mentioned that Males have more vertical movements whereas females have more horizontal movements during smile.

CONCLUSIONS

- In both males and females, upper lip length and thickness at rest and smile was higher in class I compared with other groups.
- In males, upper lip length and thickness at rest and at smile was higher in class II division 2 compared to class I and class II division 1.
- In females, upper lip length and thickness at rest and at smile was higher in class II division 1 compared to class I and class II division 2.
- Upper lip in the smile of patients with Class II division 1 was positioned downward.

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