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Lip Morphological Changes In Orthodontic Treatment (Review)

A Project submitted to

The college of Dentistry, University of Baghdad, Department of Orthodontics,
in partial Fulfillment for the Bachelor of Dental Surgery

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B.D.S, M.Sc. Orthodontics

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بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

وَمَنْ لَمْ يَجْعَلِ اللَّهُ لَهُ نُورًا فَمَا لَهُ مِنْ نُورٍ ﴿٤٠﴾

صَدَقَ اللَّهُ الْعَظِيمُ





Certification of the Supervisor



I certify that this project entitled “Lip morphological changes in orthodontic treatment” was prepared by fifth-year student **Noor Adnan** under my supervision at the College of Dentistry/ University of Baghdad in partial fulfilment of the graduation requirements for the Bachelor degree in Dentistry.

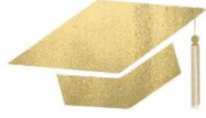
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Date

Dedication



بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

I dedicate this work to my mother, a piece of my heart for her supporting me and for getting me to where I am now. There are no words describe what she did for me, a huge amount of thanks to you, the greatest woman in the world.

To myself, who was able to reach this place and overcome the most difficult days...

Thank you from all my heart

Noor





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Table of Contents

Subject No.	Name of Subjects	Page No.
	Certification of the supervisor	I
	Dedication	II
	Acknowledgment	III
	Table of contents	IV
	List of figures	VI
	List of abbreviations	VII
	Introduction	1
	Aims of the study	2
	Chapter one: review of literature	
1.1	Classification of lip	3
1.2	Factors affecting lip competency	4
1.3	Treatment of incompetent lip	4
1.4	Growth of the lips	5
1.5	Lip line and smile line	6
1.6	Upper lip length	7
1.7	Appearance of normal smile	8

1.8	Change in maximum lip-closing force	11
1.9	Lip morphological changes in Class II	12
1.10	Lip morphological changes in Class III	17
1.11	Changes of lip vermilion in Orthodontic treatment	19
	Chaper two: Discussion and Comments	
2.1	Discussion and Comments	21
	Chapter three: Conclusions and Suggestions	22
3.1	Conclusions	22
3.2	Suggestions	22
	References	23

List of figures

No.	Name of figure	Page no.
1.1	Classification of lip: a) Competent lip, b) incompetent lip, c) potentially competent lip, d) everted lip. (Singh, 2015)	3
1.2	Growth of the lips. (Proffit et al., 2019)	5
1.3	Smile line classification: A) High smile line, B) Average smile line, C) Low smile line. (Tjan and Miller 1984)	7
1.4	Upper lip length. (Philip, 2012)	7
1.5	Ideal smile (Correa et al., 2014)	8
1.6	Posed and unposed smile. (Ackerman et al., 2002)	9
1.7	Types of smile arc: A) Consonant smile arc, B) Flat smile arc, C) Inverse smile arc. (Dong et al., 1999)	10
1.8	The smile arc is the relationship of the curvature of the lower lip to the curvature of the maxillary incisors, A) before treatment, B) after treatment. (Proffit et al., 2019)	11
1.9	Marked circumoral muscular activity in patient with Class II. (Littlewood and Mitchell, 2019)	14
1.10	Patient with a Class II division 1 malocclusion, the lower lip lies behind the upper incisors and in front to the lateral incisors. (Littlewood and Mitchell, 2019)	14
1.11	Patient with Class II malocclusion prior and post treatment. (Littlewood and Mitchell, 2019)	15
1.12	Patient with Class III malocclusion prior and post treatment. (Littlewood and Mitchell, 2019)	18

List of Abbreviations

Abbreviations	Meanings
mm	millimetre
%	Percentage



Introduction

Introduction

In the field of Orthodontic treatment, the improvement of the facial esthetics is considered an intellectual study and is the cornerstone of Orthodontic. The smile emanates from the facial movement and is the clear manifestation of the facial structures. One of the most important opportunities of Orthodontic treatment is to improve the esthetic and morphological harmony as well as the function of the oral and maxillofacial region. Recently, the relationship among such factors as occlusion, function and esthetics is emerging. What kind of harmony occurs as each part of the hard and soft tissues changes is one of the interesting topics in Orthodontics (**Shaw *et al.*, 1985; Ackerman *et al.*, 2002**). Facial esthetics is generally becoming one of the major objectives of patients seeking orthodontic or orthognathic therapies nowadays. Therefore, it is of great significance to establish individualized standard of profile beauty and distinguish its underlying correlated factor (**Rakosi *et al.*, 1993**).

The lips are significant aesthetic feature of the face, which serve important functional roles in phonation and the formation of an anterior oral seal in swallowing (**Naini, 2011**). The lip is the pivotal feature affecting the esthetics of the lower third of the face, especially as upper lip attracts the greatest attention. It has been proven that vertical lip thickness is the most influential variable in smile esthetics. Existing evidence has demonstrated that lip play crucial in facial esthetics at both static and dynamic states, which attracts people's attention at first sight during daily communication and interaction (**Evans *et al.*, 2005; McNamara *et al.*, 2008; Ghorbanyjavadpour and Rakhshan, 2019**).

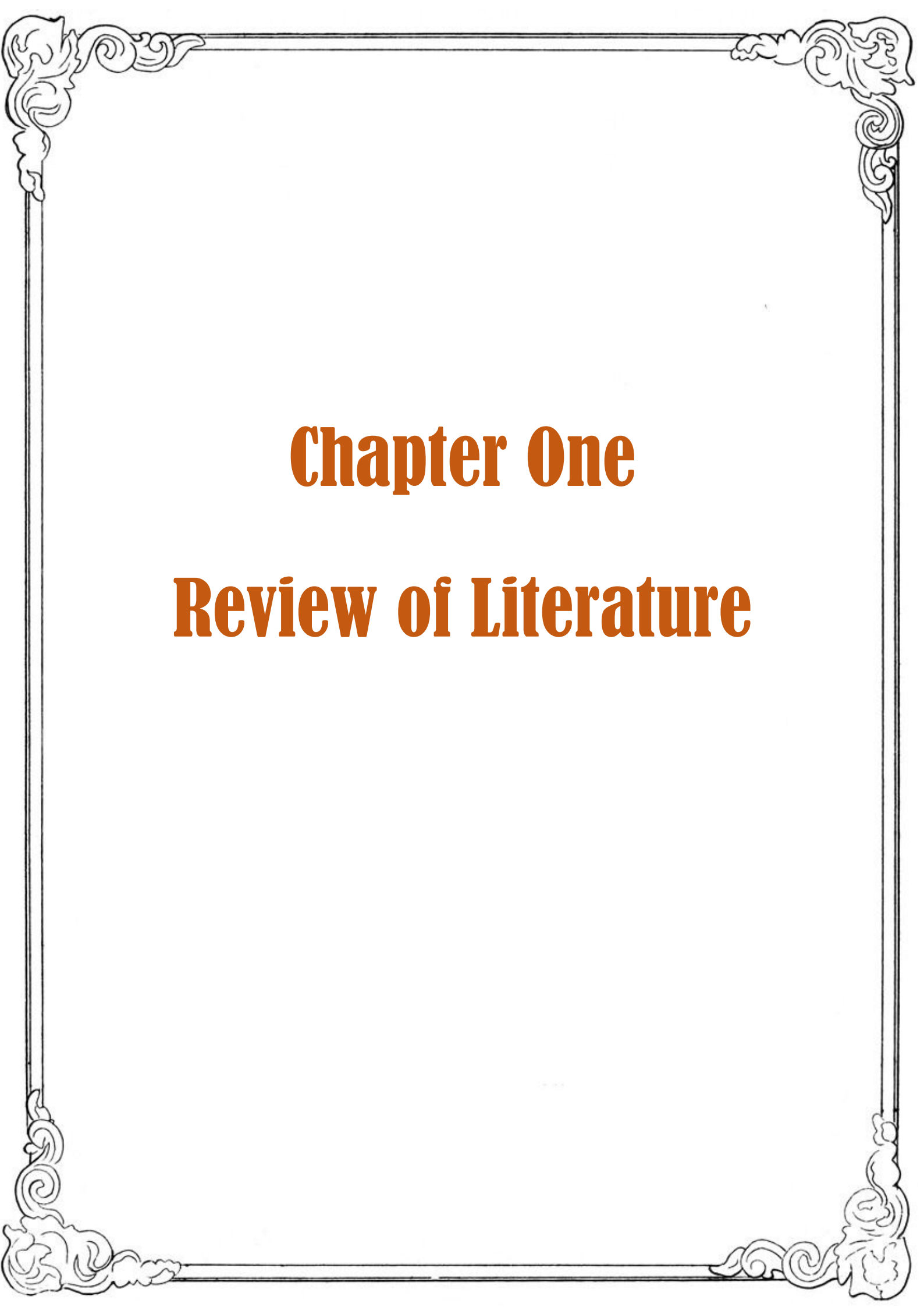
The appearance of the smile is of substantial clinical importance and one of the key criteria by which patients judge the success of their own orthodontic treatment. This is why the smile is an integral part of the diagnosis and planning, and a key point in the treatment objectives in orthodontic care (**Jantzen, 1977**).



Aims of the Study

Aims of the study

1. To determine the degree of improvement in the smile of upper and lower lips in Class II division 1 before and after treatment.
2. To evaluate the morphological changes of the lips and smile of Class II division 1 and Class III malocclusion at rest and on smiling conditions before and after orthodontic treatment.



Chapter One

Review of Literature

Chapter one: Review of literature

1.1 Classification of lip (Singh, 2015)

In a balanced face, the length of the upper lip measures one third, the lower lip and chin two third of the lower face height. The upper incisal edge exposure with the upper lip at rest should be normally 2mm.

Lip can be classified into:

- a. Competent lips: slight contact of lips when musculature is relaxed.
- b. Incompetent lips: anatomically short lips, which do not contact when musculature is relaxed. Lip seal is achieved only by active contraction of the orbicularis oris and mentalis muscle.
- c. Potentially competent lips: lip seal is prevented due to the protruded maxillary incisors despite normally developed lips.
- d. Everted lip: these are hypertrophied lips with redundant tissue but weak muscular tonicity.

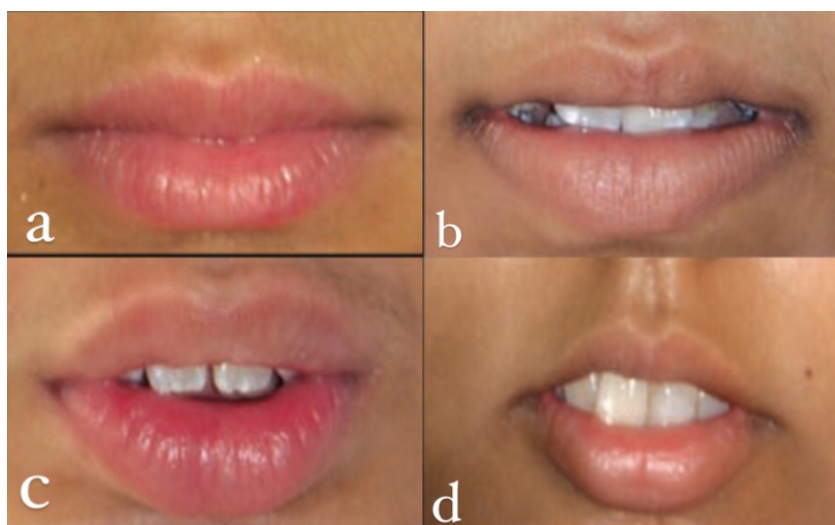


Figure 1.1: Classification of lip (a) competent lip (b) incompetent lip (c) potentially competent lip (d) everted lip (Singh, 2015)

1.2 Factors affecting lip competency

1. Age: as vertical lip growth progresses, the partition between the lips diminishes. Lip growth proceeds until around age 17, so numerous people with lip incompetence at age 13 may create a spontaneous lips-together rest posture by age 17 (**Vig and Cohen, 1979**).
2. Lower anterior face height: when lower face height increase lip separation will increase (**Philari, 2011**).
3. Anterior-posterior mandibular position: influence lip competence when mandibular retrognathia increase lip separation will increase (**Phulari, 2011**).
4. Upper incisor position: when the protrusion of upper incisor increase lip separation will increase (**Sheik and Ijaz, 2009**).
5. Lip length: normal lip length in females= 20-22mm, and in males= 20-24mm) (**Phulari, 2011**).

1.3 Treatment of incompetent lip

It could be issue of interest in numerous diverse specialities that bargain with lip esthetics such as plastic surgery, maxillofacial surgery, periodontics and orthodontics (**Bills et al., 2005; Al-Fraidy and Afify, 2012; Felemban et al., 2013**). Dentoalveolar protrusion produces a convex facial profile and dental projection that result in lip incompetence and pressure within the chin muscle. This condition is aesthetically unsatisfactory to a few patients, who look for treatment for improving facial balance. Orthodontic treatment can correct the dentoalveolar protrusion by aligning and retracting the anterior teeth and significantly improve lip posture (**Solemn et al., 2013**). Another treatment decision is orofacial myofunctional treatment, given the cause of the lip incompetence is due to issue such as swallowing abnormalities or the improper rest posture of the tongue (**Iida et al., 2017**).

Orofacial myofunctional treatment includes straight forward works out that enact specific facial muscle. When these muscles are activated, other muscles will follow until proper coordination of the tongue and facial muscles is attained (Zickefoose, 1989).

1.4 Growth of the lips

The lips trail behind the growth of the jaws before adolescence, then undergo a growth spurt to catch up. Because lip height is relatively short during mixed dentition, lip separation at rest (often termed incompetent lip) is maximal during childhood and decrease during adolescence. Lip thickness reaches its maximum during adolescence then decrease to the point that in their 20s and 30s, some women consider loss of lip thickness a problem and seek treatment to increase it (Proffit *et al.*, 2019).



Figure 1.2: Growth of the lips trails behind growth of the facial skeleton until puberty, then catches up and tends to exceed skeletal growth thereafter. As a result, lip separation and exposure of the maxillary incisors is maximal before adolescence and decreases during adolescence and early adult life. (A) Age 11-9, prior to puberty. (B) Age 14-8, after the adolescent growth spurt. (C) Age 16-11. (D) Age 18-6. (Proffit *et al.*, 2019)

1.5 Lip line and Smile line

Optimal esthetic treatment outcomes require a harmonious reconciliation between lip morphology and teeth positioning. Lips provide a picture frame for the anterior teeth that support them, with mouth size and labial contours depending on generically determined intrinsic structures and influenced by age-related skin changes. Lip position and the amount of tooth and gingival display during smiling and speech are important diagnostic criteria in orthodontics, dentofacial surgery, and aesthetic dentistry. Smiles that entirely display the teeth including some gingiva (2–4 mm) are perceived as the most aesthetic (**Kokich *et al.*, 1999; Van der geld *et al.*, 2007**).

Smile line refers to an imaginary line along the incisal edges of the maxillary anterior teeth which should mimic the curvature of the superior border of the lower lip while smiling.

Lip line should not be confused with the smile line. It refers to the position of the inferior border of the upper lip during smile formation and thereby determinates the display of tooth or gingiva at this hard and soft tissue interface (**Bhuvaneshwaran, 2010**).

Smile line was classified by Tjan *et al.* into: (**Tjan and Miller, 1984**)

- High smile line shows the entire cervico-incisal length of maxillary anterior teeth and an adjoining band of gingiva.
- Average smile reveals 75-100% of the maxillary anterior teeth and the interproximal gingival only.
- Low smile line shows less than 75% of the upper anterior teeth without any display of gingiva.



Figure 1.3: Smile line was classified according to the 3 categories: A) High smile line, B) Average smile line, C) Low smile line (Tjan and Miller, 1984)

Lip line is influenced by age. The older the individual the greater is the tendency for low lip line. High lip line tend to become average or medium lip line with age and low lip line become even lower over time. In other words, there is a possibility of self-correction for gingival smiles. The higher of the lip line decreased with age as a result of the loss of supporting tissue (Zarone *et al.*, 2017).

1.6 Upper lip length

Was defined as the distance between the base of the nose (subnasale) and the inferior part of the upper lip. Fonseca mentioned that normal upper lip length for females range from 18 to 22mm and 20 to 24mm in males. Patients with upper lip length below these ranges (<18.0 for females and <20.0 for males) were categories as having a short upper lip length. Hega *et al.* showed that upper lip length was 3.1mm shorter in women than in men (Roe *et al.*, 2012).

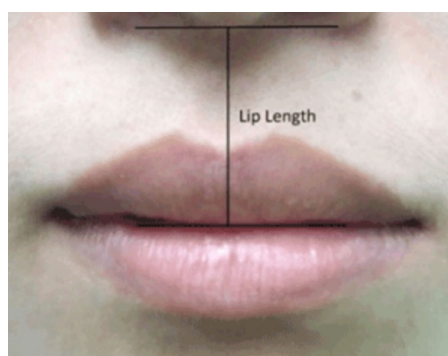


Figure 1.4: Upper lip length from the subnasal to the most inferior part at the center of upper lip (Philip, 2012)

1.7 Appearance of normal smile

The smile is the most pleasant expression of the face, translating the beauty, youth and personality of people. From this understanding, arises one of the objectives of orthodontic treatment: the ability to restore smiles adapted to the face, age and lifestyle of patients, enhancing their positive esthetic characteristics and increasing the self-esteem and self-confidence when smiling (**Seixas *et al.*, 2021**).

A true smile is a complex gesture. It is one of the most effective means by which people convey their emotions (**Hulsey, 1970**). The ideal smile is also associated with perceived good health and success. A dentition free of inflamed gingiva and calculus deposits, together with the absence of discolored unsightly teeth and fractured restorations, portrays an image of good self-care. Ruelkellerman found that people with well-aligned teeth were perceived to be more conscientious, sincere and loyal (**Correa *et al.*, 2014**).



Figure 1.5: Ideal smile (**Correa *et al.*, 2014**).

Ackerman *et al* classified smile into two basic types:

- The social smile/posed smile which is reproducible, voluntary. The lips apart due to moderate muscular contraction of the lip elevator muscles and teeth and sometime the gingival scaffold are displayed.
- The enjoyment smile/ unposed smile/ Duchenne smile, is an involuntary smile and is elicited by laughter or great pleasure and results from maximal

contraction of the elevator and depressor muscles causing full expansion of the lips, gingival show and maximum anterior teeth display (**Ackerman *et al.*, 2002**).

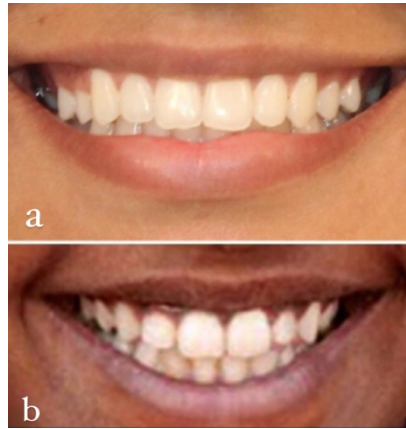


Figure 1.6: a) posed smile, b) unposed smile(**Ackerman *et al.*, 2002**)

A normal smile should show the following: (**Littlewood and Mitchell, 2019**)

1. The whole height of upper incisors should be visible on full smiling with only interproximal gingiva visible. This smile usually 1-2mm in female.
2. The upper incisor edges run parallel to the lower lip (smile arc).
3. The upper incisors should be close to but not touching the lower lip.
4. Gingival margin of the anterior teeth are important if they are visible in smile. The margins of the central incisors and canines should be approximately level with the lateral incisors lying 1mm more incisally than canines and central incisors.
5. The width of the smile should be such the buccal corridors should be visible but minimal. The buccal corridors is the space between the angle of the mouth and the buccal surface of the most distal visible tooth.
6. There should be a symmetrical dental arrangement.
7. The upper dental midline should be coincident to the midline of the face.

The smile arc was considered as:

1. Consonant and pleasant: when it looks younger and presents the curvature of the upper incisal line similar to the curvature formed by the lower lip when smiling.
2. Flat: when presented a flattened upper incisal line in relation to the curvature of the lower lip.
3. Inverse: when presented a more aged appearance, in which the upper incisal line forms an opposite curvature to that formed by the lower lip during social or voluntary smile.

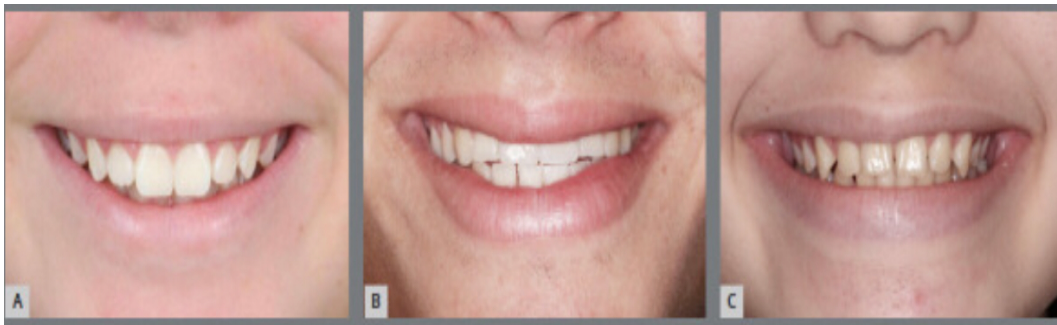


Figure 1.7: Types of smile A) Consonant smile arc B) Flat smile arc, C) Inverse smile arc
(Dong *et al.*, 1999)

According to Dong et al 60% of patients presents smile types (consonant and pleasant), 34% present type (flat) and 5% (inverted)(Dong *et al.*, 1999).

Desai et al reported that the arc of the smile is related to the age of the individual. In youth, the central incisors are more prominent, generating a curve that is parallel with the lower lip, while in older individuals curve tend to be straighten as a result of wear (Desai *et al.*, 2009).

So, for best appearance, the contour of the incisal edge of the maxillary anterior teeth should parallel the curvature of the lower lip. If the lip and dental contours match, they are said to be consonant.

A flattened (nonconsonant) smile arc can pose either or both of two problems: it is less attractive, and it tends to make the patient look older (because older individuals often have wear of the incisors that tend to flatten the arc of the teeth). The data indicates that the most important factor smile esthetics, the only one that by itself can change the rating of a smile from acceptable to unaesthetic, is the smile arc (**Proffit *et al.*, 2019**). So, the arc of the smile can be defined as the relationship between the curve of the incisal margins of the upper incisors and canines and the curve of the lower lip in a posed smile (**Sarver, 2001**).



Figure 1.8: The smile arc is the relationship of the curvature of the lower lip to the curvature of the maxillary incisors. The appearance of the smile is best when the curvatures match. (A) A flat smile arc, which is less attractive in both males and females, before treatment. (B) The same girl after treatment. The improvement in her smile was created solely by lengthening her maxillary incisors—in her case, with dental laminates rather than orthodontics.

(**Proffit *et al.*, 2019**)

1.8 Changes in maximum lip-closing force

The lip-closing function or pursing is an essential movement during various stomatognathic system including: food intake, chewing, swallowing, speech and facial expressions. With regard to the lip force, primarily in the rest position, static pressure has a remarkable impact on the teeth and jaws.

Tomiyama et al reported that the electromyographic activity of the orbicularis oris muscle in the clinical rest position was greater in subjects with incompetent lips than in those with competent lips. In contrast, other study showed that the electromyographic activity of the orbicularis oris muscle at rest was similar in subjects with competent lips and those with incompetent lips.

Moreover, Doto and Yamada found that the lip-closing force was weaker in patients with skeletal Class II malocclusion than in those with skeletal Class III malocclusion. In addition to the enhancement of facial esthetics, an improvement in the lip-closing force after surgical orthodontic approach such as orthognathic surgery and surgically assisted rapid palatal expansion was recently reported.

There have been few studies on the changes in the lip after orthodontic treatment and their correlation with dentofacial and dental arch dimensional changes. The lip force can be affected by various factors including: age, gender and skeletal dental patterns. Partal and Aksu also found that the vertical lip pressure did not differ between subjects with Class I malocclusion and those with Class II division 1. In contrast, some studies suggested that the lip strength in individuals with Class II division 1 malocclusion was lower than that in individuals with Class I malocclusion (**Choi et al., 2020**).

1.9 Lip morphological changes in Class II

The treatment goal of modern orthodontic and orthognathic treatment is to produce morphological and functional harmony in maxillofacial complex. Smile arc and teeth exposure on smile are the common parameter to evaluate the dynamic function of the lips. It was demonstrated that the attractiveness of smile is enhanced when smile arc of lower lip coincides with the tip lines of upper anterior teeth, and the anterior teeth exposure is about 75 to 100% while smiling. Facial expression and physical attractiveness in general form essential parts of social interaction. A pleasing smile clearly enhance of an individual in our society.

On the other hand, a defective smile might be considered properly as a physical handicap. It has been well documented that considerable importance is placed on dental esthetics, and both parents and their children feel that pleasant dental aesthetics are an important factor for physical well being. Persons with crowded dentitions are not only considered less attractive by lay people, but also are perceived to be less intelligent, whereas children with well aligned teeth are thought to be friendlier of a higher social class, more popular and more intelligent. Young adults are aware to varying of anterior occlusal traits and this is particularly so in those who seek orthodontic treatment (**Wylies, 1955; Subtelny, 1961;**).

The prediction of lip change in response to tooth movement has commonly been express as the ratio of maxillary and mandibular incisors retraction to lip change (**Bishara *et al.*, 1995**). Class I indicates maxilla and mandible are in harmonious relative position, Class II indicates the maxilla relatively prognathic compared with mandible and Class III indicates more protruded mandible relative to maxilla (**Rakosi *et al.*, 1993**).

Class II division 1 malocclusion characterized by upper anterior teeth protrusion resulting in upper lip protrusion and convex facial profile, which are considered esthetically unfavorable. Treatment of this malocclusion comprises growth modification by orthopedic appliances such as headgear or functional appliances, orthodontic treatment with or without extraction in patients with mild to moderate skeletal discrepancies and orthognathic surgery in adults patients with severe skeletal discrepancies (**Bishara, 2006**).

Both the upper and lower lips in the smile of patients in the Class II division 1 pretreatment group were positioned downward, and the upward movement of the upper lip and mouth corners was smeller in comparison with the normal occlusion. These characteristics of the Class II smile improve after treatment (**Islam *et al.*, 2009**).

In Class II division 1 malocclusion, the lips are often incompetent due to the prominence of the upper incisors and/or the underlying skeletal pattern. If the

lip are incompetent, a patient can try to achieve an anterior oral seal in a number of different ways. How this anterior oral seal is achieved will affect the presentation of the Class II division 1 incisor relationship.

The following are different methods of achieving an anterior seal:

- Circumoral muscular activity to achieve a lip to lip seal.



Figure 1.9: Marked circumoral muscular activity is visible as this patient attempts to achieve an anterior oral seal by a lip-to-lip seal (Littlewood and Mitchell, 2019)

- The mandible is postured forwards to allow the lips meet at rest.
- The lower lip is drawn up behind the upper incisor which have been proclined and in front of the lateral incisor which have been retroclined.



Figure 1.10: In this patient with a Class II division 1 malocclusion, the lower lip lies behind the upper central incisors which have been proclined, and in front of the lateral incisors which have been retroclined as a result (Littlewood and Mitchell, 2019)

If the lip to lip contact is not possible, the lower lip functions by being drawn up behind the upper incisor. The effect of this is to retrocline the lower labial segment and procline upper incisor (**Littlewood and Mitchell, 2019**).



Figure 1.11: A Class II division 1 malocclusion due mainly to retroclination of the lower labial segment by an active lower lip. This patient achieved an anterior oral seal by contact between the tongue and the lower lip

(a) Prior to treatment (b) post treatment (**Littlewood and Mitchell, 2019**)

Bowman and Johnston analyzed 120 Class I and Class II orthodontic Caucasian patients, 50 were treated non-extraction and 70 were treated with various combinations of premolar extraction. The authors concluded that extraction treatment had an esthetic effect that was proportional to the patient's pretreatment lip. In contrast, non-extraction treatment had little effect on facial esthetics (**Bowman and Johnston, 2001**).

Excessive protrusion of the incisors revealed by prominent lips that are separated when they are relaxed, so that the patient must strain to bring the lips together over the protruding teeth. For such a patient, retracting the teeth tends to improve both lip function and facial esthetics. On other hand, if the lips are prominent but close over the teeth without strain, the lip posture is largely independent of tooth position. For that individual retracting the incisor would have little effect on lip function or prominence. Lip prominence is strongly influenced by racial and ethnic characteristics and to a considerable extent also is age dependent.

Greater degrees of lip and incisor prominence normally occur in individuals of Asian and African descent. More lip prominence now is being recognized as a desired esthetic quality. Lip posture and incisor prominence should be evaluated by viewing the profile with the patient's lip relaxed. This is done by relating the upper lip to a true vertical line passing through the concavity at the base of the upper lip (soft tissue point A) and by relating the lower lip to a similar true vertical line through the concavity between the lower lip and chin (soft tissue point B).

- If the lip is significant forward of this line, it can be judged to be prominent, if the lip falls behind this line, it is retrusive.
- If the lip are both prominent and incompetent (separated by more than 3 to 4mm), the guideline is that the anterior teeth are excessively protrusive.
- Lip relationships with the nose and chin affect the perception of lip fullness.
- Larger the nose, the more prominent the chin must be to balance it, and the greater the amount of lip prominence that will be aesthetically acceptable.
- Some patients with short lower facial height have everted and protrusive lips because they are over closed and the upper lip passes against the lower lip, not because the teeth protruded.
- If there is 6mm crowding in both arches and normal overjet and the incisors need to be moved back 3mm to correct lip protrusion and incompetence, 12mm of space in the dental arch would be needed.
- The lips will move about two-thirds of the distance that are incisor retracted (i.e., 3mm of incisor retraction will reduce lip protrusion by 2mm), but there is a great deal of individual variation, primarily lip retraction stops when the protruding lips come into contact at rest (i.e., when lip competence has been achieved) (**Proffit *et al.*, 2019**).

1.10 Lip morphological changes in Class III

A Class III malocclusion is rare as compared to other type of malocclusions, with an incidence of possibly less than 5 percent. It is of special interest to the orthodontists because it offers a therapeutic challenge. It is usually a progressive type of malocclusion, which makes it difficult for the clinician to predict the future growth of such patients both in magnitude and direction. Even after achieving good results and following the cessation of active treatment these patients have a high tendency for relapse. As the concept of growth and its prediction become more clear, treatment for Class III malocclusion also improved. Still, the treatment of Class III malocclusion is challenging. Although various treatment modalities are available, which aim at the correction of a Class III malocclusion during the growth period, these have proved unsuccessful in maintaining the results for a long time. Retention appliances are required to be worn until growth is complete. Relying on the patient to cooperate over long period and extent treatment protocols is a potential problem in achieving successful, stable treatment results. Surgical intervention may be still needed in a few cases. At present, orthodontic patients are concerned with their dynamic appearance during conversation and smiling, in addition to their static appearances (**Ackerman *et al.*, 1999**).

Treatment of moderate to severe Class III malocclusion frequently requires a combination of orthodontics and orthognathic surgical procedures. In most cases, the aims of such procedures are not only to correct the dental malocclusions but also to improve facial esthetics and to harmonize the facial profile. Therefore, it is important for the clinician to be able to predict the soft tissue changes resulting from alterations of the hard tissue. Many studies have attempted to evaluate the relationship between hard tissue surgery and the effects it has on the overlying soft tissue.

In the pretreatment group, both lip areas were significantly larger than those of the control group at rest and while smiling. The upper/lower lip ratio was 80% at rest and 60% on smiling.

In the posttreatment group, both lips area in the rest and smiling positions were larger than those of the control group. But the lower lip at rest and the upper and lower lip during smiling were significantly larger. The upper/lower lip ratio was 70% at rest and 50% on smiling. The lip ratio of the Class III posttreatment group in smiling was the same as that of the control group. This indicated that the orthognathic treatment improved upper and lower lip balance.

Both upper and lower lips in the smile of Class III pretreatment group were positioned downward, and the upward movement of the upper lip and mouth corners was smaller in comparison to control group. When smiling, the horizontal direction of the mouth corners was statistically significantly different between the pretreatment and posttreatment, whereas these were wider in the posttreatment than in the pretreatment. These characteristics of the Class III smile were improved after orthognathic treatment, but the differences with control group remained unchanged immediately after treatment (Islam *et al.*, 2010).



Figure 1.12: Patient with a severe Class III skeletal pattern, further complicated by developmentally absent maxillary second premolars and grossly infraoccluded deciduous predecessors, treated with a combination of orthodontics and bimaxillary orthognathic surgery (a-b) initial presentation, (c-d) post treatment (Littlewood and Mitchell, 2019)

1.11 Changes of lip vermilion in orthodontic treatment

Orthodontic tooth movement can bring about considerable changes in the morphology of the perioral soft tissues surrounding the dentition and occlusion. Proffit *et al* mentioned a paradigm shift in current orthodontics, referring to the concept of the soft tissue paradigm and noted that the importance of soft tissues has been recognized not just from the point of view of esthetics but also as a treatment goal (Proffit *et al.*, 2012).

Peck and Peck have indicated that since the lips and teeth are fundamental elements of the facial profile, orthodontists should give consideration to the esthetics of the mouth through trade-offs between dentition and soft tissues (Peck and Peck, 1995). Lip morphology has been considered one of the most important elements for facial esthetics so that there have been numerous reports on the factors affecting attractive or desirable lip morphology that have focused on areas other than profile (Gunn *et al.*, 2009; Kim *et al.*, 2015). Especially in orthodontic field, the anteroposterior position of the upper and lower incisors affects lip morphology and some studies on incisor retraction and change in lip morphology have been published (Kachiwala *et al.*, 2009).

Ioi *et al* studied the effects of the difference in vermilion lip height on lip esthetics with subjective items (Ioi *et al.*, 2014), and they concluded that vermilion lip morphology may have a large effect on facial harmony. Changes in vermilion lip morphology with aging (Gunn *et al.*, 2009) and the effects of premolar extraction on changes in vermilion lip morphology have been previously reported (Trisnawaty *et al.*, 2013).

In addition to the change in sagittal lip position, the lip vermilion also shows morphological changes during retraction of anterior teeth. The lip vermilion is a prominent facial feature because of its vibrant color in contrast to facial skin and thus plays a key role in the frontal facial esthetics. The lip vermilion shape and proportion are therefore esthetic determinations for both orthodontics and patients (McNamara *et al.*, 2008; Ioi *et al.*, 2014).

Thus, the treatment modality of extracting four premolars has been chosen to straighten the facial profile and make lip seal easy. We also showed that as a result of the posterior movement of anterior teeth, this treatment significantly decreased the vermilion height from the increased height that results from labially inclined anterior teeth toward the average vermilion height. Considering these results in conjunction with those obtained in the present study, extraction treatments not only improve facial profiles but could also decrease vermilion height toward the attractive average value in the frontal view (**Trisnawatay *et al.*, 2012**). Marked decrease in vertical height of the vermilion may prove to be esthetically pleasing for the patient with excessive vermilion; whereas it may prove esthetically disastrous for the patient exhibiting relatively small vermilion heights before treatment (**Perkins *et al.*, 1993**).



Chapter Two

Discussion and Conclusions

Chapter two: Discussion and Comments

2.1 Discussion and Comments

At present, patients believe that they will become more attractive, better liked and more successful in their social and occupational life after orthodontic treatment, and the facial esthetics is one of the important social corners in current society (**Shaw, 1985**). Eighty percent of patients seek orthodontic treatment for esthetic reasons (**Albino *et al.*, 1981**).

Facial attractiveness influence mating success, kinship opportunities, personality evaluation, performance and employment prospects. Therefore, orthodontic treatment has gained momentu, in modern society and therefore, will attract even more attention in the future. The success of orthodontic treatment is routinely assessed by smile esthetics, and the lips are the controlling factor in the smile. Wylie emphasized that the goal of orthodontic treatment should be the attainment of the best possible esthetic result, dentally and facially (**Wylie, 1955**).

In Class II division 1 pretreatment, the upper lip area and the upper and lower lip riation are larger than in control in the smile. It may be due to the protrusive upper incisors in Class II division 1 which make the upper lip loose and everted. On the other hand, a deep overbite may also evert the lower lip. It is possible that the abnormal overjet and overbite increase the lip area and lose the upper and lower lip balance. After the treatment, in the smile, the angle of the mouth corners become wide and near the control, but both lips were still positioned downward. Cummins et sl showed in their study that in the posttreatment of Class II division 1 malocclusion, the mouth corners were wider than in pretreatment (**Cummins *et al.*, 1995**). Ishikawa et al studied the smile in Class III malocclusion and they reported that both lips showed a larger downward displacement (**Ishikawa *et al.*,2007**).



Chapter Three

Conclusions and Suggestions

Chapter three:

Conclusions and Suggestions

3.1 Conclusions

1. Both the upper and lower lips in the smile of the Class II division 1 pretreatment group moved to an inferior position, and the upward movement of the upper lip and mouth corners was smaller in comparison with the dental group. These characteristics of the Class II smile were improved by the orthodontic treatment, but the differences in comparison with the control group remained immediately after treatment.
2. The hypothesis is true that there is a different in the morphology of the lips of Class II division 1 and Class III malocclusion at rest and on smiling conditions, before and after orthodontic treatment. Orthodontic treatment induced larger amount in movement of lips at rest and on smiling in both Class II and Class III patients, which may reflect the emotional changes in the patients after treatment.

3.2 Suggestions for further studies:

1. Extend the study to include a large number of participant of younger and older age group.
2. Studying the lip morphological changes in growing patients.

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