

การศึกษาเปรียบเทียบความหนาริมฝีปากในคนไทย ที่มีลักษณะโครงสร้างใบหน้าที่แตกต่างกัน

Comparison of Lip Thickness Among Different Types of Skeletal Pattern in Thai Adults

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บทคัดย่อ

การเปลี่ยนแปลงบริเวณริมฝีปากภายหลังจากการรักษาทันตกรรมจัดฟันเป็นสิ่งที่พบได้ทั่วไป นอกจากการเปลี่ยนแปลงของการสบฟันและตำแหน่งของฟันรวมถึงกระดูกขากรรไกรบน การทำ การรักษาทันตกรรมจัดฟันจึงมุ่งไปที่การปรับเปลี่ยนเนื้อเยื่อรอบริมฝีปากควบคู่ไปกับการสร้างการสบ ฟันที่ดีให้คนไข้ ปัจจัยที่ส่งผลต่อการเปลี่ยนแปลงของเนื้อเยื่อรอบริมฝีปากประการหนึ่งคือ ความหนา ตั้งต้นของริมฝีปาก จุดประสงค์ของการศึกษานี้คือ การประเมินและเปรียบเทียบความหนาตั้งต้นของ ริมฝีปากในคนไทยที่มีลักษณะโครงสร้างใบหน้าที่แตกต่างกันแบ่งตามความสัมพันธ์ของขากรรไกรบน และขากรรไกรล่างในคนไข้ผู้ใหญ่ 45 คน แบ่งเป็น 3 กลุ่ม กลุ่มละ 15 คน โดยทำการวัดความหนาตั้ง ต้นของริมฝีปากจากภาพถ่ายรังสีด้านข้าง ผลการศึกษาพบว่ามีความแตกต่างกันอย่างมีนัยยะสำคัญ ในความหนาตั้งต้นของริมฝีปากบนและล่างบางตำแหน่ง ระหว่างกลุ่มตัวอย่างทั้ง 3 กลุ่ม ทั้งนี้จากผล การศึกษาอาจกล่าวได้ว่า ในคนไทยที่มีลักษณะโครงสร้างใบหน้าที่แตกต่างกัน จะมีความหนาตั้งต้น ของริมฝีปากในหลายตำแหน่งที่แตกต่างกัน ซึ่งสามารถนำไปศึกษาต่อในเรื่องการเปลี่ยนแปลงของ เนื้อเยื่อรอบริมฝีปากจากการรักษาจัดฟันในแต่ละกลุ่มคนที่มีลักษณะโครงสร้างใบหน้าที่แตกต่างกันได้

คำสำคัญ: เนื้อเยื่อรอบริมฝีปาก ริมฝีปาก ความหนาริมฝีปาก ลักษณะโครงสร้างใบหน้าที่แตกต่างกัน

Abstract

Objectives: This study aimed to evaluate and compare lip thickness among various types of skeletal patterns (Class I, II, and III) in the Thai population.

Research Methodology: Forty-five Thai adults (19 males and 26 females) who sought orthodontic treatment were divided into three groups, based on the skeletal patterns (Class I, II, and III). Pre-orthodontic lateral cephalograms were used for the identification of 5 soft tissue and 5 hard tissue landmarks showing the measurement of lip thickness at Subnasale, Labrale superius, Stomion, Labrale

inferius, and Labiomentale. The average lip thickness of each group was evaluated and compared using ANOVA. The p -value less than 0.05 was statistically significant.

Results: The mean upper lip thickness, as measured at Labrale superius point, in the Class III group was 13.50 mm, which was significantly more than that of the Class II group whereas the mean upper lip thickness in the Class II group was not significantly different from that of the Class I group. In the lower lip, the mean thickness, as measured at Labrale inferius point, in the Class II group was 13.33 mm, which was significantly more than those of Class I and Class III group respectively.

Conclusions: Skeletal pattern is the important factor related to the difference of upper and lower initial lip thickness. There were significant differences in lip thickness among different types of skeletal patterns in the Thai population. In the upper lip, the Class III group had the greatest amount of initial lip thickness whereas, in the lower lip, Class II showed the greatest amount of initial lip thickness.

Keywords: Facial soft tissue thickness, skeletal patterns, facial profile, lip thickness

Introduction

Improved soft tissue esthetics has become an important treatment objective and people tend to focus more on lip changes than on changes of the nose or chin (Burcal et al., 1987). Orthodontic treatment can change tooth position and overlying soft tissue, resulting in changes in the contour of lips, and perioral region (Park & Burstone, 1986). However, lip response seemed to be influenced not only by the amount of incisor retraction but also by the lip structure relating to lip thickness and skeletal patterns (Lew, 1992).

Prediction of the upper and lower lips move in response to the tooth movement was defined as the ratio of maxillary and mandibular incisors retraction to lips retraction (Yogosawa, 1990). The ratio varied among several studies due to differences in genders and ethnicities. It was generally found that the upper lip changed, both in the vertical and anteroposterior direction, with incisor retraction, but these changes are not fully predictable or explainable because of many variables such as lip thickness, lip tonicity, initial incisor inclination, lip length, and lower lip proximity (Diels et al., 1995). Some studies supported the hypothesis that variation in soft tissue, namely, its thickness, length, and postural tone, leads to different soft tissue changes in response to hard tissue retraction (Brock et al., 2005).

Lip thickness was the important variable that had been widely investigated in the effect on soft tissue response. It was also found that lip structure seemed to

influence lip response (Wisth, 1974). It was found that skeletal patterns influenced the lip thickness while different types of malocclusion showed the different thickness of perioral soft tissue (Thüer & Ingervall, 1986). An investigation of this factor in different types of skeletal patterns revealed different soft tissue responses in the other studies (Utsuno et al., 2010). Few studies have investigated the soft tissue thickness of patients with different skeletal malocclusions (Utsuno et al., 2014). However, an evaluation of the lip thickness among different types of malocclusion in the Thai population has never been thoroughly investigated.

Objectives

- 1) To evaluate the lip thickness among various types of skeletal pattern
- 2) To compare the lip thickness among various types of skeletal pattern

Literature Review

Improving facial profile is one of the main reasons people seeking for orthodontic treatment because it affects their quality of life, self-image, social behavior, and public perception (Kerosuo et al., 1995). Therefore, the role of an orthodontist is not only to create ideal dental and skeletal relationships but also to improve facial profiles (Leonardi et al., 2010).

The soft tissue response to extraction therapy has been suggested to be predictable and consistent (Hodges et al., 2009). The linear relationship between hard and soft tissue changes is defined as the ratio. Most studies have used ratios to quantify lip response to incisor retraction in premolar extraction cases. Ratios of the amount of maxillary incisor retraction to that of upper lip retrusion have been reported to vary from 1.2:1 to 3.2:1. Ratios for the horizontal response of the lower lip, ranging from 0.4:1 to 1.8:1, are slightly more consistent across studies (Brock et al., 2005). Orthodontic treatment with extraction generally results in 2-3 millimeters of lip retraction, which eventually flattens the facial profile (Bravo et al., 1997). Many studies suggested that soft tissue changes are highly unpredictable. There seems to be a high individual variation of soft tissue response to extraction therapy (Konstantonis, 2012).

Variation in soft tissue changes may be caused by many different factors such as ethnicity, initial protrusion, initial lip thickness, and dentoskeletal morphology (Tadic & Woods, 2007). Pretreatment lip thickness tends to exert the greatest influence on changes in lip retraction (Wholley & Woods, 2003). It was the important variable that has been investigated widely in the effect to soft tissue response and

lip structure seems to influence lip response (Garner, 1974). Some studies supported the hypothesis that soft tissue may vary enough in thickness, length, and postural tone to cause the different response of soft tissue to hard tissue retraction depending on initial lip thickness (Brock et al., 2005). Some studies reported that patients with thin lips or high lip strain showed a significant correlation between incisor retraction and lip retraction, whereas patients with thick lips or low lip strain displayed no such correlation (Oliver, 1982).

The behavior of the perioral soft tissues, especially the upper lip, demonstrates great independence from underlying hard tissue changes due to the complex functional musculoskeletal anatomy of the nose and upper lip complex (Tadic & Woods, 2007). The upper lip may still be supported by the apical base of the bone and remaining alveolar process even when the incisors are retracted, which contributes to the variability of the upper lip response. The lower lip, on the other hand, shows more predictable changes because it is free and away from the bony support of the mandible, and thus can closely follow incisor retraction (Hodges et al., 2009).

Few studies have investigated the soft tissue thickness of patients with different skeletal malocclusions (Utsuno et al., 2014). Although many studies supported the dentoskeletal factor, some studies reported that there was no statistical difference in lip thickness among various types of skeletal patterns (Kamak & Celikoglu, 2012).

Conceptual Framework

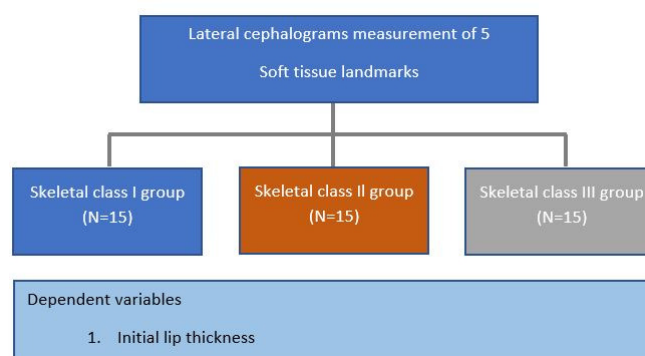


Figure 1. Conceptual framework of the study

Research Methodology

Subjects

This retrospective cohort study was conducted from 2017 to 2020 at the Postgraduate Clinic, Faculty of Dentistry, Bangkokthonburi University. This study was approved by the Human Ethics Committee of Bangkokthonburi University (11/2561).

The samples consisted of 45 Thai adults (19 men and 26 women with a mean age of 25.3 ± 4.2 years) who had received bicuspid-extraction orthodontic treatment. They were divided into 3 groups equally by types of skeletal patterns (Class I, Class II, and Class III). The three skeletal patterns were classified as follows: class I, ANB angle = $0-4^\circ$, class II, ANB angle $>4^\circ$ and class III, ANB angle $< 0^\circ$. The lateral cephalometric records with high-quality radiographs at pre-treatment of 45 patients having undergone routine orthodontic treatment were selected based on the treatment modality provided and availability of records of adequate diagnostic quality. Patients who presented with severe craniofacial anomalies, such as facial asymmetry, need for orthognathic surgery approach, and history of previously extracted was excluded from the study. All patients were treated by the same orthodontist.

Lateral cephalograms analysis

Standard lateral cephalograms were used for data collection. These lateral cephalograms were recorded by positioning the head in a standard cephalometric device (Veraviewepocs 2D[®], J. Morita, Kyoto, Japan). The magnification ratio of the lateral cephalograms was 1.1. The head was fixed in a way that the sagittal plane was at a right angle to the path of the X-rays and the Frankfort Horizontal Plane (FHP) was parallel to the horizontal plane. Teeth were occluded in the centric occlusion and lips were maintained in a relaxed position. Cephalograms were traced by ImageJ software. Corrected values of the linear measurements were recorded to eliminate the magnification error of 10%.

The skeletal class was determined from the ANB angle which assesses the anteroposterior relationship between the maxilla and the mandible to the cranial base. Three hard tissue landmarks were measured as follows: (A) the deepest point on the line between the anterior nasal spine (ANS) and the prosthion; (B) the deepest point from the line between the infradentale (apex of the alveolar bone between the right and left lower first incisors) and the pogonion; and (N) the nasion, located on the suture between the frontal and nasal bones. (Figure 2 A). The 3 skeletal types were classified as Class I= ANB angle $0-4^\circ$ (15 subjects); Class II,

=ANB angle greater than 4 degrees (15 subjects); and Class III= ANB angle less than 0 degrees (15 subjects).

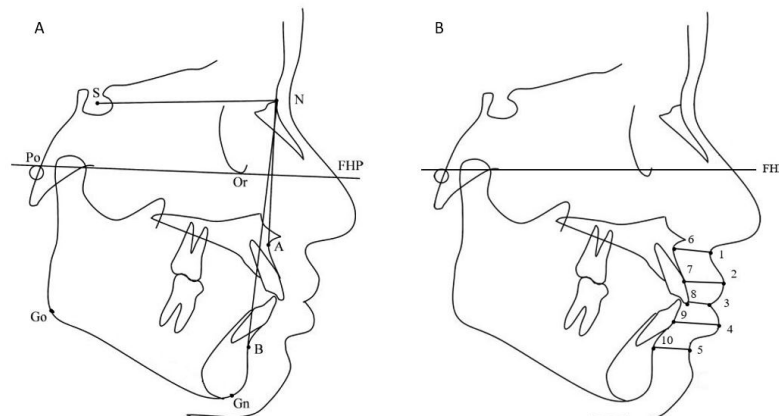


Figure 2. **A**, ANB angle formed by point A, nasion (N), and point B was used to determine the skeletal class of the subject. **B**, Lateral cephalograms of hard tissue and soft tissue landmarks used in this study: 1. Subnasale; 2. Labrale superius; 3. Stomion; 4. Labrale inferius; 5. Labiomentale; 6. Point A; 7. Prosthion; 8. Upper incisor; 9. Infradental and 10. Point B

After measuring ANB to identify the skeletal class and setting the Frankfort Horizontal Plane (FHP) as the horizontal reference plane, lip thickness was measured at the following cephalometric landmarks of hard tissue and soft tissue: (1) Subnasale (Sn); (2) Labrale superius (Ls); (3) Stomion (Sto); (4) Labrale inferius (Li); (5) Labiomentale (Lm); (6) Point A (A); (7) Prosthion (Pt); (8) Upper incisor (U1); (9) Infradental (Id); and (10) Point B (B) (Figure 2 B).

The following anterior-posterior linear measurement of lip thickness were made at 5 points: (1) The distance between point A and subnasale (Sn-A); (2) upper lip thickness, the distance between Labrale superius and Prosthion (Ls-Pr); (3) the shortest distance between the upper incisor and Stomion (U1-stom); (4) lower lip thickness, the distance between Labrale inferius and Infradentale (Li-Id); (5) the distance between Labiomentale and point B (B-Lm).

Measurement Reliability

Each landmark was measured three times by the same investigator. Actual measurements were recalculated based on 10% magnification in lateral cephalograms. The intra-examiner reliability was assessed using interclass correlation coefficients (ICCs). The ICCs values of the lip thickness measurement acquired from this study ranged from 0.81 to 0.85.

Statistical analysis

According to checking the data normality, the Shapiro-Wilk test was applied. Parametric tests were used for statistical analysis due to the normal distribution of data. All statistical analyses were performed using the computer program SPSS (20.0, SPSS Inc., Chicago, USA) for windows. In addition to descriptive statistics, one-way analysis of variance (ANOVA) was used, followed by Bonferroni *post hoc* tests for multiple comparisons among the three groups in each skeletal pattern group. The level of statistical significance was set at 5 % ($p < 0.05$).

Results

The mean age of the 45 subjects was 25.3 ± 4.2 years. Descriptive statistic was shown as mean thickness and standard deviation of each measurement point among 3 skeletal pattern groups (Table 1). In the upper lip measurement, at Sn point, soft tissue thickness in Class III group was greater than class I and Class II group but there was no significant difference. At Ls point and Sto point, a significant difference was observed between the Class III and Class II group. The measurement was significantly greater in the Class III group than the Class II group ($P < 0.05$).

In the lower lip measurement, the mean thickness at Li point was significantly greater in the Class II group than the Class I group and class III group respectively ($P < 0.05$). However, there was no significant difference at the Lm point among the 3 groups (Table 2).

Table 1: Mean and standard deviation of facial soft tissue and hard tissue measurement for the three groups (n=45)

Class	Class I		Class II		Class III	
	(N=15)		(N=15)		(N=15)	
Variables	Mean	±SD	Mean	±SD	Mean	±SD
Sn-A	14.09	1.21	13.95	1.19	14.41	1.27
Ls-Pr	12.54	1.50	12.22	1.53	13.49	1.16
Sto-U1	4.30	0.87	4.01	0.67	4.86	0.89
Li-Ld	13.06	1.18	13.33	1.23	12.18	1.30
Lm-B	12.26	1.25	12.79	1.06	12.45	1.14

*The definition of soft tissue and hard tissue landmarks are given in Figure 2

Table 2: Comparison of lip thickness at each landmark among the three groups of skeletal class (n=45)

Variables	Skeletal class	Skeletal class	Mean	±SD	P-value
Sn-A	Class I	Class II	0.14	0.47	0.740
		Class III	-0.31	0.47	0.458
	Class II	Class III	-0.45	0.47	0.285
Ls-Pr	Class I	Class II	0.31	0.49	0.532
		Class III	-0.96	0.49	0.059
	Class II	Class III	-1.27	0.49	0.014*
Sto-U1	Class I	Class II	0.30	0.29	0.317
		Class III	-0.57	0.29	0.061
	Class II	Class III	-0.87	0.29	0.005**
Li-Ld	Class I	Class II	-0.27	0.32	0.398
		Class III	0.87	0.32	0.009**
	Class II	Class III	1.15	0.32	0.015*
Lm-B	Class I	Class II	-0.53	0.41	0.201
		Class III	-0.19	0.41	0.645
	Class II	Class III	0.34	0.41	0.409

*The definition of soft tissue and hard tissue landmarks are given in Figure 2.

Bonferroni *post hoc* tests were applied following the use of one-way Anova

*, *P*-value < .05; **, *P*-value < .001

Discussions

In this study, the objective was to evaluate the perioral soft tissue thickness at the lower face in Thai adults with different skeletal patterns and to compare the initial lip thickness among different types of skeletal pattern groups. This assessment in a Thai population has not been previously reported in the literature. The study investigated both upper and lower lip with 5 measurements of thickness in each soft tissue landmark.

In the upper lip Sn point revealed no significant difference in each skeletal pattern while at Ls point and Sto point, the measurement was a greater significant difference between groups. The factor related to this finding was the importance of soft tissue overlying dental part and skeletal part. Sn point represented the lip thickness at A point which was the skeletal structure whereas the Ls and Sto point represented the thickness at the cervical and tip of the upper incisor known as the dental part. In the lower lip, Li represented the lip thickness at the cervical part of lower incisor showed greater different value among groups than Lm represented the lip thickness at B point.

In the literature, some studies have analyzed facial soft tissue thickness in Japanese children representing several different skeletal classes (Utsuno et al., 2010).

They also reported that the largest differences were observed between skeletal classes II and III patients having significant differences in soft tissue depth at the upper and lower lip. Lip thickness in skeletal class I was intermediate between that in classes II and III. In skeletal class II patients with convex facial profile, the upper lip was thinner than in the other two skeletal classes in the upper lip region and thicker in the mental region (Utsuno et al., 2014). The lower lip thickness showed no significant difference. On the other hand, in skeletal class III patients with a concave profile, soft tissue was thicker than in the other two skeletal classes at the upper and lower lip and thinner at the mental region. Hence, the convex skeletal profile has thinner soft tissue in the upper lip region and thicker soft tissue in the mental region, and this pattern is reversed for the concave skeletal profile (Utsuno et al., 2014).

Conclusions

The skeletal pattern is the important factor related to the difference of upper and lower initial lip thickness and the measurement showed that in the upper lip, the Class III group had the greatest amount of initial lip thickness whereas, in the lower lip, Class II showed the greatest amount of initial lip thickness.

Acknowledgments

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Suggestions

More investigation in lip thickness measurement in three-dimension would help providing more knowledge in lip structure and lip response among different type of skeletal patterns.

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