

# H angle hard tissue, H angle soft tissue and visual perception of a facial profile of a skeletal type II Thai female

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**Objectives:** To compare the correlation of H angle hard tissue and H angle soft tissue with the visual perception of skeletal type II patients.

**Materials and Methods:** 59 lateral cephalograms of female patients from year 2016 to 2018 were hand traced and analysed by using ANB > 5.69 to define skeletal type II category. The principal investigator traced the soft tissue profile outline of the cephalograms and transformed it into silhouettes for performing profile rating by the specialists. Profile ratings were done by two orthodontists on Visual Analogue Scale (VAS) with increasing levels of convexity. Rankings of visual perceptions (profile rating) were correlated with cephalometric measurements using Spearman correlation coefficient.

**Results:** The result of this study showed that there was no statistically significant difference between the correlation of H angle hard tissue and H angle soft tissue with the visual perception. The analysis of correlation between H angle hard tissue and H angle soft tissue showed a statistically significant correlation. The increase in facial convexity was correlated with higher values of both H angle hard tissue and H angle soft tissue. In this study, H angle hard tissue and H angle soft tissue showed comparatively an almost equal correlation with values of 0.63 and 0.65 respectively.

**Conclusion:** Both H angle hard tissue and H angle soft tissue had almost equal agreement with the visual perception. Therefore, either H angle hard tissue or H angle soft tissue can be used in cephalometric analysis to determine the facial profile of skeletal type II patient.

**Keywords:** H angle, Hard Tissue, Soft Tissue, Skeletal type II, Visual perception

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## Introduction

Patients seek orthodontic treatment with variety of chief complaints. Although the particular reason is to improve function, they also seek for aesthetics and for the betterment of facial harmony. Never the less, purpose of an orthodontist should not be just to achieve functional occlusion but also to assess the patient's problems to improve the facial balance through proper diagnosis and treatment

planning [1]. The facial aesthetics was considered important since the start of the orthodontic speciality. Edward H Angle believed that an aesthetic or harmonious face required a full complement of teeth, but many authors who came after him questioned this notion. Today more so than at any time in our speciality, orthodontists have the ability to study, predict and produce aesthetic results which previously thought unattainable.

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The skeletal system of classification was first given by Salzman in 1950, where he classified patients into skeletal type I, type II, and type III. He stated that the profile of type I was straight, type II was convex, and type III was concave [2]. While there are many cephalometric measurements to determine the relative antero-posterior positions of maxilla to mandible, ANB is the most commonly used by measurement [3]. According to a study of Professor Hasund at the university of Bergen, the main guiding variable in an evaluation of the magnitude of H angle is related to the ANB angle which was in agreement with the findings of Holdaway. Similarly, H angles were used to determine the facial profile of orthodontic patients. H angle hard tissue is the angle formed by the NB line (nasion to point B) and the H line (line tangent to upper lip and soft tissue pogonion). Whereas the H angle soft tissue or the revised H angle is the angle formed by N'PG line (Soft tissue nasion to soft tissue pogonion) and H line (line tangent to upper lip and soft tissue pogonion). According to the study by Holdaway in 1983, clinically the H angle soft tissue or the revised H angle is better than H angle hard tissue or the original H angle. He mentioned that the variation of the soft tissue at the chin area was not considered in the original H angle or the H angle hard tissue [4].

Various methods have been used to evaluate facial characteristics, such as anthropometry [5], photogrammetry [6,7], computer imaging [8], and cephalometry [9, 10]. Numerous angles have been used to assess facial aesthetics, H angles [4], Z angle [11], Stoners soft tissue analysis [12]. With the advent of the cephalometric head films, various analysis was developed in an attempt to qualitate and quantitate aesthetic facial profiles [13]. But the measurements obtained from cephalometric analysis are more of objective and can vary from patient's perception of ideal. The perception of facial profile and dental aesthetics are fundamentally based on how subjects assess themselves. Although the perception can be

drawn from subjective and objective outcomes, facial attractiveness for a patient should be determined mainly by how he or she look at the glance rather than all the objective measurements [14]. Hence choosing proper objectives measurements that corelate to the visual perception (subjective outcomes) can help in proper diagnosis and treatment planning.

## Materials and methods

This retrospective study was conducted by using lateral cephalometric films of 59 Thai female patients who were selected from initial sample of 250 individuals. We included only the female samples as the number of male samples were very insignificant compared to female. The ethical approval was obtained from the committee for research ethics, Faculty of Dentistry, Mahidol university. The inclusion criteria were subjects with complete records including the chart records and pre-treatment lateral cephalograms, aged between 20-22 years, skeletal type II ( $ANB > 5.69$ ), no previous history of orthodontic treatment, all radiographs with adequate resolutions and quality for proper identification of all necessary hard and soft tissue landmarks, and all radiographs taken from the same orthopantomograph.

### Study Procedure:

Lateral cephalometric films of the 59 female patients were hand traced and analysed by the principal investigator. The films were then categorised into skeletal type I ( $1.97 \leq ANB \leq 5.69$ ), Skeletal type II ( $ANB > 5.69$ ) and skeletal type III ( $ANB < 1.97$ ). From all the set, only films that represented skeletal type II were chosen for this study. The films were further traced separately (only the soft tissue profile outline) and labelled with an identification numbers by the principal investigators.

### Step 1: Visual perception of facial profile.

All the copies of the traced profile were visually examined and graded from score 1-10 by the two specialist of the Orthodontic Department, Mahidol university. (Figure 1)

### Step 2: H angle soft tissue and H angle hard tissue measurements.

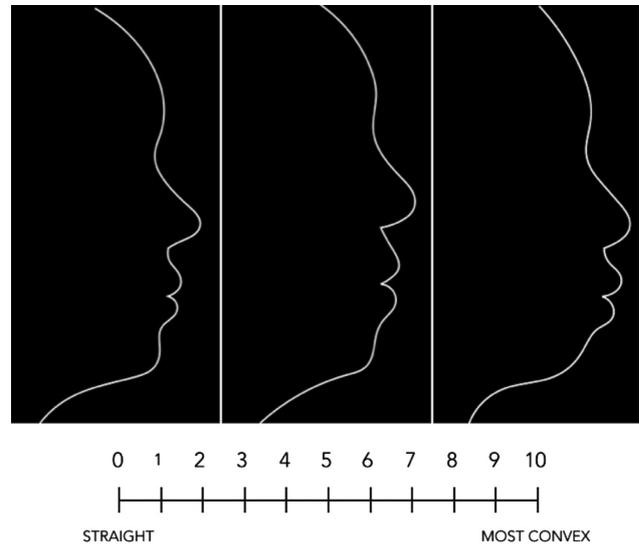
1. Copies of the pre-treatment lateral cephalometric films were made (skeletal type II)

2. The lateral cephalometric films were hand traced and analysed by the principal investigator following the Mahidol university protocol, beginning with the cranial base, maxilla, mandible, and soft tissue profile on a clear sheet of acetate paper. The H angle hard tissue (NB-H line) and the H angle soft tissue (N' PG- H line) (Figure 2) were measured with a millimetre ruler and protractor.

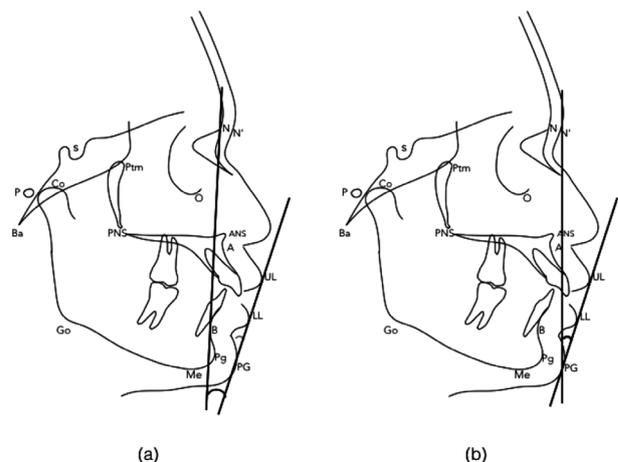
SPSS version 18, SPSS Inc, Chicago,16 USA was used to calculate the means and Standard deviation of all the parameters. Normality of the data was examined by using Kolmogorov- Smirnov test. The spearman correlation coefficient was used to find the correlation between the H angles and the Visual perception of skeletal type II. The P- Value of  $< 0.05$  was considered significant for this study. Cronbach alpha reliability coefficient was used to measure the intra and inter observer reliability. Cronbach alpha reliability range from 0-1, the closer the values to 1, the better is the reliability. However, the Cronbach alpha values greater than 0.6 is considered to have a good agreement [15].

## Results

The mean and standard deviation of the measurements are given in Table 1. The Cronbach's alpha for the evaluation of visual perception is 0.612 between the raters (inter-observer reliability) and 0.896 for the individual raters (intra-observer reliability). To summarize the results:



**Figure 1** Representative silhouettes obtained from lateral cephalograms of patients (straight to most convex) for the ease of perception rating (VAS) by the orthodontists.



**Figure 2** (a) H angle hard tissue and (b) H angle soft tissue

(1) This study showed high correlation between H angle hard tissue and H angle soft tissue ( $p$  value = 0.88)

(2) H angle hard tissue and H angle soft tissue showed comparatively an almost equal correlation with values of 0.63 and 0.65 respectively

(3) The average ANB of skeletal type II Thai female is 7.271.38

**Table 1** Mean and standard deviations of the measurements used in this study

Measurements	Mean	Standard Deviation
ANB angle	7.27	1.384
H angle Hard tissue	16.39	3.289
H angle soft tissue	20.00	2.419
Visual Perception	4.57	0.499

**Table 2** Correlations of H angle hard tissue and H angle soft tissue with the visual perception.

	H angle soft tissue	H angle hard tissue	Visual perception
H angle soft tissue	1.000	0.888*	0.630*
H angle Hard tissue	0.888*	1.000	0.656*
Visual perception	0.630*	0.656*	1.000

\*significant at  $P < 0.05$

## Discussion

In today's world, an appealing face has become an important physical trait. Unknowingly we happen to relate sought after personal traits like mental capability and sociability with appealing face. The applicability of facial attractiveness in dentistry has become popular at present. Still the main objective circled around the improvement of dento-alveolar structure with a belief that the correction of soft tissue will happen automatically after the correction of hard tissue. But somehow this does not always happen [16]. Many orthodontists had an unpleasant experience, where patients face looked worse after the orthodontic treatment. Therefore, we should determine beforehand such that our planned orthodontic treatment will not end in adverse facial change [4]. For this reason, this study was conducted to find the correlation of H angles with the visual perception.

Although in the previous studies, authors have used H angle soft tissue for the facial profile assessment in cephalometric analysis [17;18], at the faculty of dentistry, Mahidol university H angle hard tissue is used. There are no studies making comparison between the H angle hard tissue and

H angle soft tissue until now. So, it was of great interest to conduct this study at the Orthodontic clinic, Mahidol University. The clinical implication is, this study will give an idea whether H angle soft tissue or H angle hard tissue has better correlation with the visual perception. So that there can be an agreement between objective assessment and the subjective assessment of the facial profile leading to a better diagnosis and treatment planning [19,20].

Holdaway in 1983 mentioned that the H angle soft tissue was better than the H angle hard tissue in clinical point of view. However, the methodology is different from this study, so it is not comparable to the current study. Silvia et al confirmed that the facial convexity and anterior chin projection are key determinant of facial aesthetics [21]. Our samples were skeletal type II because it is more common and has higher treatment need than skeletal type III world-wide [22-24]. More over Thai female aged between 20-22 were included in this study as there were very few male samples which could not result in significant result. According to the study of Padmaja et al, there was a greatest change in soft tissue profile from age 10-15 years and there was average decrease in facial convexity after the age

of 25. Hence the sample in this study are neither influenced by growth nor influenced by aging [25].

Mohamed et.al conducted a study with similar methodology, where they studied correlation of facial attractiveness between photographs and measurements from lateral cephalogram. They used pre-treatment photos and cephalometric radiographs to find correlation between objective measurements and subjective measurements. Rating for attractiveness was performed on 5 point attractive scale with values from 1-5 [26] which was similar to this study. Zuber et.al also included 2 clinicians to evaluate the facial profile of the subjects separately. Similarly, in this study 2 raters evaluated the visual perception on silhouettes from lateral cephalogram. The study of Geraldo E M et al used Hold away H line, nasolabial angle and distance from the H line to nasal tip to find the correlation between cephalometric measurement and perception. Their study found that there was significant correlation between subjective and objective ratings [19]

However, there was no any study making comparison between H angle hard tissue and H angle soft tissue with the visual perception of the facial profile. Moreover, in the above-mentioned studies, they used photographs rather than the profile outline from the cephalograms. This study used the profile outline from cephalogram (silhouettes) because many factors in a photograph can affect the visual perception like shape, colour, distance from addition structures, quality of photograph and movement, which all can have an impact on the findings of the study [28]. Therefore, in this study profile outline from cephalogram was later converted into silhouettes to make it more standardized and to have no effect of colour or shape on the perception.

## Conclusions

1. There is a very high correlation between H angle hard tissue and H angle soft tissue of facial profile of skeletal Type II Thai female patients.
2. Either H angle hard tissue or H angle soft tissue can be used to measure the facial profile as there is no significant difference between the correlation of H angle hard tissue and H angle soft tissue with the visual perception.
3. Skeletal type II Thai females have slightly convex to convex facial profile.

## Conflicts of Interest

There is no conflict of interest regarding this study as per the authors are concerned.

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