Original Article
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Dentoskeletal and Facial Profile Changes Following Orthodontic Treatment with Extraction and Non-Extraction in Class II Division 1 Patients

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Abstract

The purpose of the study was to evaluate the skeletal, dental and facial profile changes following orthodontic treatment with extraction and non-extraction. Pretreatment and postreatment cephalograms of 95 Class II division 1 Thai patients, treated with non-extraction (51 patients, mean age 10.5±1.3 years) and extraction (44 patients, mean age 11.8±1.3 years), were superimposed to evaluate the dentoskeletal changes. The effect of treatment on the facial profile was determined by nasolabial angle and Lower lip to E line value. Results of the study showed that cervical headgear can redirect the maxillary growth into more downward direction and enhance the mandibular growth in the anterior and downward direction. There were greater significantly skeletal changes in the non-extraction group than those in the extraction group, whereas dentoalveolar changes in horizontal direction were greater in the extraction group. Lower lip was more retracted in the extraction group. Correction of Class II division 1 malocclusion was accomplished mainly by orthopedic effect in the non-extraction group and by orthodontic effect in the extraction group. Both treatment protocols had the favorable effect on the soft tissue profile.

Key words: Cervical headgear; Class II division1 malocclusions; Extraction; Non-extraction

Introduction

Possible scenarios that may influence the treatment of Class II malocclusions are the inhibition of the forward and downward growth of maxillary complex, moving the maxillary teeth distally, stimulating the horizontal growth of mandible and creating space by selective extractions to allow the desired tooth movements.[1] These may be accomplished by orthopedic and/or orthodontic treatment. Management of Class II division 1 malocclusions depends on the developmental stage of patient. In growing patients, the growth modification is designed to redirect growth of the maxilla and to allow the mandible to express its maximum potential. In non-growing patients, extraction of premolars is a method to treat dental discrepancies and to camouflage mild skeletal discrepancies.[1]

Cervical headgear is an extraoral appliance widely used in Class II treatment. Its effect is not only the retraction of upper teeth but also the effect on the maxillary growth.

Numerous studies[2-4] have been undertaken to evaluate the efficiency of this appliance, mostly on maxillary growth. Kirjavanien et al[5] found that cervical headgear treatment was associated with a decreased facial convexity caused by the restriction of forward growth of the A-point, while mandible continued to grow forward at a normal rate. Ciger et al[4] suggested that during cervical headgear treatment, the maxillary growth was restricted, maxillary incisor inclination, overjet, and overbite were decreased and redirection of the maxillary growth remained stable at the postretention period. Schiavon Gandini et al.[6] demonstrated that cervical headgear corrected the Class II division 1 malocclusions by maintaining the maxillary first molars and redirecting dentoalveolar growth in the maxilla, rather than by significantly changing growth of the maxillary jaw base.

Few studies had evaluated the effect of cervical headgear on the mandibular growth. Keeling et al.[7] revealed that the headgear enhanced the mandibular growth in the anterior direction along the occlusal plane without detectable relapse a year after the end of active treatment.

Currently, the goals of treatment representing a paradigm shift, the soft tissues are recognized as the major consideration in justification the successful of treatment, focusing on improving not only dental and skeletal but also soft tissue aspects of orthodontic problems.[8] Previous study[9] suggested that premolar extraction may lead to "dished-in" profile. Other studies[10,11] concluded that orthodontic treatment seemed to have a favorable effect on facial profiles of both extraction and non-extraction groups of Class II division 1 patients, both in short- and long-term. Bishara et al.[12] studied the changes in subjects with Class II malocclusions treated with and without the extraction of four first premolars. They found that, after the treatment, the average soft tissue and skeletal measurements for both groups were close to the corresponding averages derived from the Iowa normative standards. Based on the result from various studies, the extraction or non-extraction decisions, if based on sound diagnostic criteria, seem to have no deleterious effects on the facial profile.

The purpose of this study was to evaluate the skeletal, dental and facial profile changes in patients with Class II division 1 malocclusions following orthodontic treatment with extraction and non-extraction.

Material and Methods

The study sample, retrospectively obtained from pretreatment and posttreatment lateral cephalomgrams of Class II division 1 malocclusion Thai patients who were treated by the 2nd researcher. The sample comprised of 95 growing patients (46 boys, 49 girls) who presented with Class II molar relationship which varied from one half to one premolar width. They were divided into 2 groups according to their dental and skeletal development.

Group I comprised of 51 patients (26 boys, 25girls) aged 8-13 years old (mean age 10.5±1.3 years). Their dental stages were varied from the early mixed dentition to the late mixed dentition. The skeletal development determined from the hand wrist film had not passed the peak of pubertal growth when compared to the Thai norm.[13] All subjects were treated as a non-extraction case by means of extraoral cervical traction followed by edgewise fixed appliances. Treatment protocol comprised of two stages:

Stage 1: To obtain Class I molar relationship and to improve intermaxillary relationship, differential growth of the maxilla and mandible being guided by the extraoral orthopedic force. The patients were recommended to wear the cervical headgear that delivered 1,000 grams force via the permanent maxillary first molars. The extraoral facebow tilted 20 degrees upward in relation to the inner facebow that was placed parallel to the occlusal plane as described by Melsen.[14] The patients wore this appliance for 12-14 hours a day.

Stage 2: To obtain normal overbite and overjet, the interdental spaces created by distalization of the permanent maxillary first molars, premolars and canines being utilized for the retraction of the maxillary incisors with the edgewise mechanism. The intramaxillary traction with elastic chain and 0.016" x 0.022" closing loop were used in the maxillary arch to close the interdental spaces and to reduce the excessive overjet, respectively. The mandibular teeth were aligned with conventional archwire.

After stage 2, the cervical headgear delivered 200 grams force was used in the patient whose craniofacial growth scrutinized from the hand wrist film had not passed the end of the pubertal growth spurt when compared to the Thai norm. The average treatment time was 32.6±12.7 months.

Group II comprised of 44 patients (20 boys, 24girls) aged 9-14 years old (mean age 11.8±1.3 years). Their dental stages

were in the permanent dentition. The skeletal development determined from the hand wrist film was between the peak and the end of pubertal growth when compared to the Thai norm. All subjects were treated as four first premolars extraction cases by means of edgewise fixed appliances with segmented arch technique. Average treatment time was 25.3±6.8 months.

Cephalometric analysis

Cephalometric evaluation was based on regional superimpositions. Landmarks of the cranial base, maxilla, mandible, maxillary central incisor, maxillary first molar, mandibular central incisor and mandibular first molar were traced on acetate paper by the first researcher.

Displacements of the maxillary and mandibular positions were expressed as changes in the X- and Y-coordinates of each reference point. For skeletal measurement, the S-N plane of pretreatment radiograph (T1) served as the X axis and the perpendicular line at the S point served as the Y axis. (fig.1) For dental measurement, Downs' occlusal plane (a line bisecting the occlusion of the first molars and central incisors)[15] of pretreatment radiograph served as the X axis and the perpendicular line at the mesiobuccal cusp of first molar served as the Y axis. (fig.2-3) Posttreatment radiographs (T2) were superimposed on the stable structures of the pretreatment radiographs.

Skeletal changes were evaluated by superimposition of the T2 to T1 films on the stable structures of the cranial base as described by Melsen.[14] (fig.1) Movement of the maxillary teeth was evaluated by superimposition of T2 to T1 films with modified best-fit method (fig.2) using the contour of the oral part of the palate, the contour of the nasal floor and the entrance of the incisive canal.[16] Movement of the mandibular teeth were evaluated by superimposition T2 to T1 films on the stable structures of the mandible (fig.3) as described by Bjork.[16]

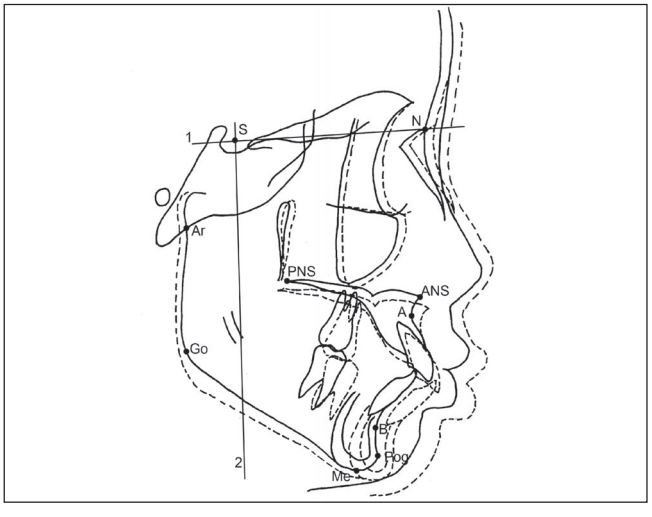

Fig. 1 *Reference point and reference plane for skeletal measurement*

Line1 *X-axis: SN line of T1*

Line2 *Y-axis: SN perpendicular line of T1*

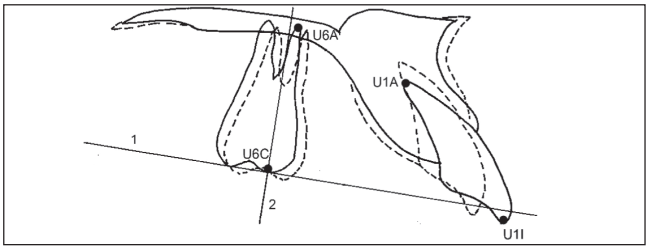

Fig. 2 *Reference point and reference plane for maxillary teeth measurement*

U1I *The incisal edge of the most prominent maxillary incisor*

U1A *The apex of the most prominent maxillary incisor*

U6C *The tip of the mesiobuccal cusp of the maxillary first molar*

U6A *The apex of the mesiobuccal root of the maxillary first molar*

Line1 *X-axis: Occlusal plane of T1*

Line2 *Y-axis: perpendicular line at the mesiobuccal cusp of maxillary first molar of T1*

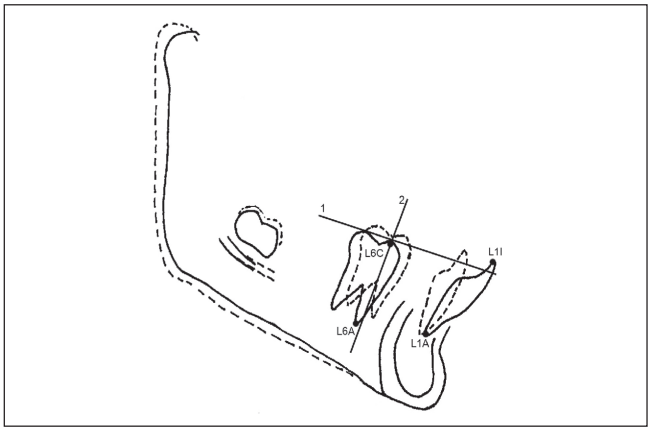

Fig. 3 *Reference point and reference plane for mandibular teeth measurement*

L1I *The incisal edge of the most prominent mandibular incisor*

L1A *The apex of the most prominent mandibular incisor*

L6C *The tip of the mesiobuccal cusp of the mandibular first molar*

L6A *The apex of the mesiobuccal root of the mandibular first molar*

Line1 X-axis : Occlusal plane

Line2 Y-axis : perpendicular line at the mesiobuccal cusp of mandibular first molar

The effect of treatment on the facial profile was determined by differences of nasolabial angle (NLA), and lower lip to E-line value (fig. 4) between pre- and posttreatment. Nasolabial angle and lower lip to E-line value of posttreatment of each group were compared to the Thai norm.

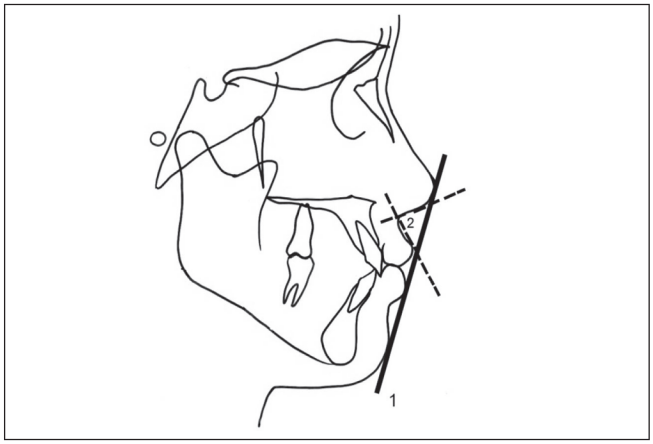

Fig. 4 *Measurement of the soft tissue profile*
1. E-line, 2. Nasolabial angle

Error study

To evaluate tracing and measurement errors, pre- and posttreatment radiographs of 10 patients were randomly selected, retraced and measured at least 2 weeks after the first measurement. Paired t-tests did not show any statistically significant differences ($p > .05$) between the first and second measurements for any variables.

Statistical analysis

Intragroup changes were evaluated by Paired t-test and intergroup differences were evaluated by independent t-test at 0.05 significant level.

Results

Pretreatment characteristics of patients were presented in Table 1. Regarding the SNA, SNB, ANB and FMA angles, the sample had skeletal Class II normal bite due to retrusive mandible when compared to the Thai norm. There were significant differences of maxillomadibular relation between the two groups. The non-extraction group had larger ANB, this might be due to slightly more protrusive maxilla than those of the extraction group. Regarding the UI-NA and LI-NB, the sample had protrusion of maxillary and mandibular incisor when compared to the Thai norm. The extraction group had more protrusion of maxillary and

Table 1 *Pretreatment characteristic average and standard deviations*

	Thai norm		Non-extraction group		Extraction group		Significance between group
	Average	s.d.	Average	s.d.	Average	s.d.	
SNA(degree)	83	4	83.46	3.78	82.44	3.51	ns
SNB(degree)	79	3	77.73+	3.25	77.67+	3.38	ns
ANB(degree)	4	2	5.74+	2.02	4.77+	2.13	*
FMA(degree)	25	4	24.55	4.16	26.17	4.06	ns
UI-NA(mm.)	6	2	6.69	2.48	8.63+	2.32	***
LI-NB(mm.)	6	2	7.80+	1.78	8.85+	2.49	*
LL-E line(mm.)	3.5	2	4.58+	2.40	5.57+	2.54	*
NLA angle(degree)	91	8	93.22	11.7	93.93	11.67	ns

+significance between average of group and Thai norm ($p \leq .05$)

significance between group: *$p \leq .05$, **$p \leq .01$, ***$p \leq .001$; ns indicate not significant

mandibular incisor than those of the non-extraction group significantly. Regarding lower lip to E-line value, the samples had lower lip protrusion when compared to the Thai norm.

Regarding the treatment effect of extraction and non-extraction on dentoskeletal and facial profile changes. After treatment (Table 2, Fig. 5), at the anterior part of maxilla, both

Table 2 *Changes of skeletal, dental and soft tissue profile within non-extraction and extraction group*

			Non-extraction group					Extraction group				
			Pretreatment		Posttreatment			Pretreatment		Posttreatment		
			Average	s.d.	Average	s.d.	Significance	Average	s.d.	Average	s.d.	Significance
1	ANS	(x)	65.34	3.91	66.02	3.85	**	64.72	3.75	65.57	3.89	***
		(y)	53.26	2.46	57.17	3.19	***	54.23	2.85	56.73	3.26	***
2	PNS	(x)	15.81	2.83	15.25	3.00	**	15.55	2.43	14.90	2.52	***
		(y)	46.08	2.50	48.89	3.15	***	47.00	2.83	48.83	3.19	***
3	A	(x)	61.63	4.11	61.82	4.06	ns	61.32	3.79	61.49	4.04	ns
		(y)	58.84	2.85	62.81	3.40	***	60.13	3.30	62.98	3.55	***
4	B	(x)	47.69	5.93	49.25	6.31	***	47.74	6.08	47.85	7.18	ns
		(y)	95.06	4.09	102.88	4.53	***	98.65	4.19	104.33	5.08	***
5	Pog	(x)	46.37	6.05	48.39	6.44	***	45.98	6.91	46.51	8.12	ns
		(y)	105.78	4.42	114.73	5.62	***	109.43	5.67	116.42	6.86	***
6	Me	(x)	37.78	6.36	39.89	6.60	***	37.40	7.23	37.80	8.39	ns
		(y)	111.55	4.51	120.88	6.01	***	115.10	5.54	122.40	6.83	***
7	Ar	(x)	-18.68	2.85	-20.30	3.07	***	-18.89	2.79	-19.88	2.94	***
		(y)	29.27	2.83	31.25	3.40	***	29.33	3.07	30.66	3.45	***
8	Go	(x)	-18.75	4.37	-20.80	5.27	***	-18.53	4.00	-20.35	4.83	***
		(y)	71.25	4.47	79.13	5.65	***	73.18	4.15	77.97	5.09	***
9	U1I	(x)	38.62	2.39	37.31	2.46	***	37.91	2.55	32.99	2.50	***
		(y)	-1.67	0.78	-3.08	1.24	***	-1.47	0.72	-3.52	1.73	***
10	U1A	(x)	23.13	2.27	23.70	2.19	*	22.13	2.48	21.41	2.66	**
		(y)	16.22	1.22	16.19	1.48	ns	15.97	1.26	16.94	1.71	***
11	U6C	(x)	0.00	0.00	1.25	1.55	***	0.00	0.00	3.93	1.21	***
		(y)	0.00	0.00	-3.68	1.09	***	0.00	0.00	-2.40	1.36	***
12	U6A	(x)	1.46	1.38	1.61	1.78	ns	1.19	1.39	3.77	1.27	***
		(y)	18.71	0.55	15.49	1.25	***	18.93	0.25	16.77	1.46	***
13	L1I	(x)	31.24	2.05	31.41	2.30	ns	29.95	2.18	26.50	2.49	***
		(y)	2.05	0.81	3.71	1.49	***	1.43	0.83	3.10	1.53	***
14	L1A	(x)	21.16	1.84	20.82	1.91	ns	19.28	2.27	18.47	2.54	***
		(y)	-17.83	1.04	-15.88	1.54	***	-18.33	1.06	-17.88	1.54	ns
15	L6C	(x)	0.00	0.00	1.97	1.42	***	0.00	0.00	3.67	1.35	***
		(y)	0.00	0.00	2.90	1.44	***	0.00	0.00	2.64	1.39	***
16	L6A	(x)	-3.42	1.52	-0.61	1.44	***	-3.53	1.81	0.91	1.64	***
		(y)	-20.30	0.50	-17.75	1.54	***	-20.24	0.45	-17.85	1.44	***
17	LL-E line(mm.)		4.58	2.40	3.30	1.92	***	5.57	2.54	2.65	2.40	***
18	NLA(degree)		93.22	11.70	98.88	9.94	***	93.93	11.67	97.97	12.74	***

Significance between group $*p \leq .05$, $**p \leq .01$, $***p \leq .001$; ns indicates not significant

1-16(x) positive values mean forward movement, negative values mean backward movement

1-16(Y) positive values mean upward movement, negative values mean downward movement

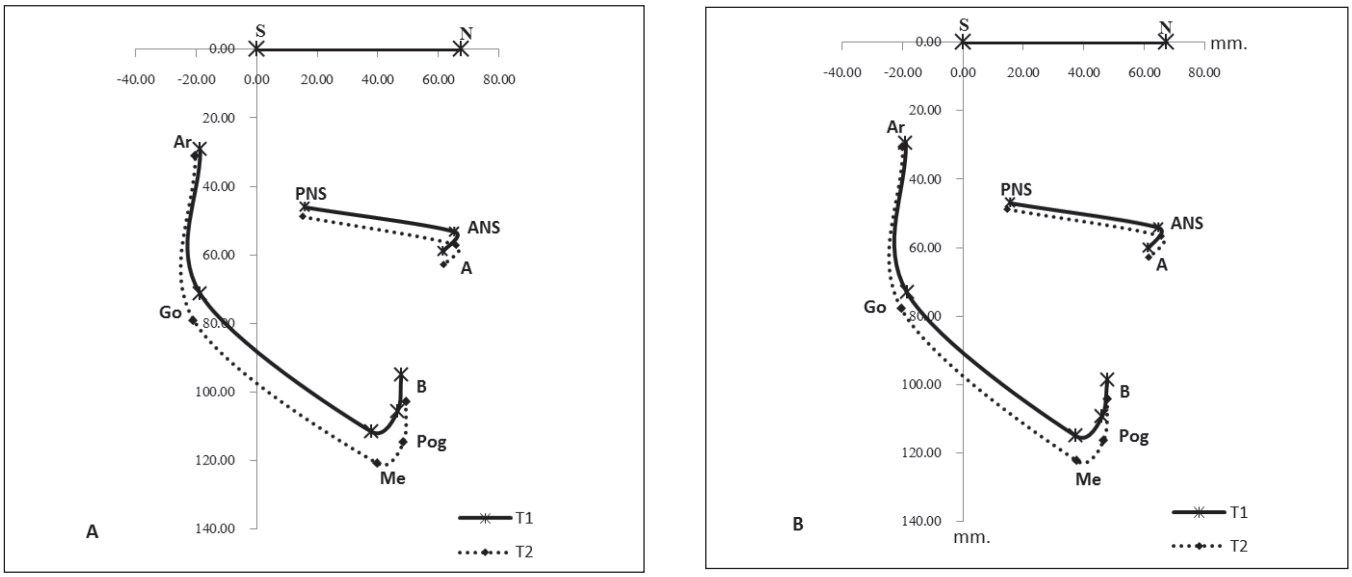

Fig. 5 *The displacement of maxilla and mandible (A. non-extraction group, B. extraction group)*
X-axis: SN line, Y-axis: SN perpendicular line T1: pretreatment, T2: posttreatment

groups exhibited forward and downward displacement of ANS significantly but A point moved only downward significantly, posterior part of maxilla (PNS) moved backward and downward significantly in both groups. Anterior part of mandible (B, Pog, Me) moved forward and downward significantly in non-extraction group but moved only downward significantly in extraction group. Posterior part of mandible (Ar, Go) moved backward and downward significantly in both groups. For dental measurement (Table 2, Fig.6-7), the maxillary incisors (U1I) moved backward and downward, the maxillary molars (U6C) moved forward and downward, the mandibular molars (L6C, L6A) moved forward and upward significantly in both groups. The mandibular incisors (L1I) moved upward significantly in non-extraction group and moved backward and upward significantly in extraction group. For treatment effect on soft tissue profile, there was significantly decrease in lower lip to E-line value and increase in nasolabial angle in both groups.

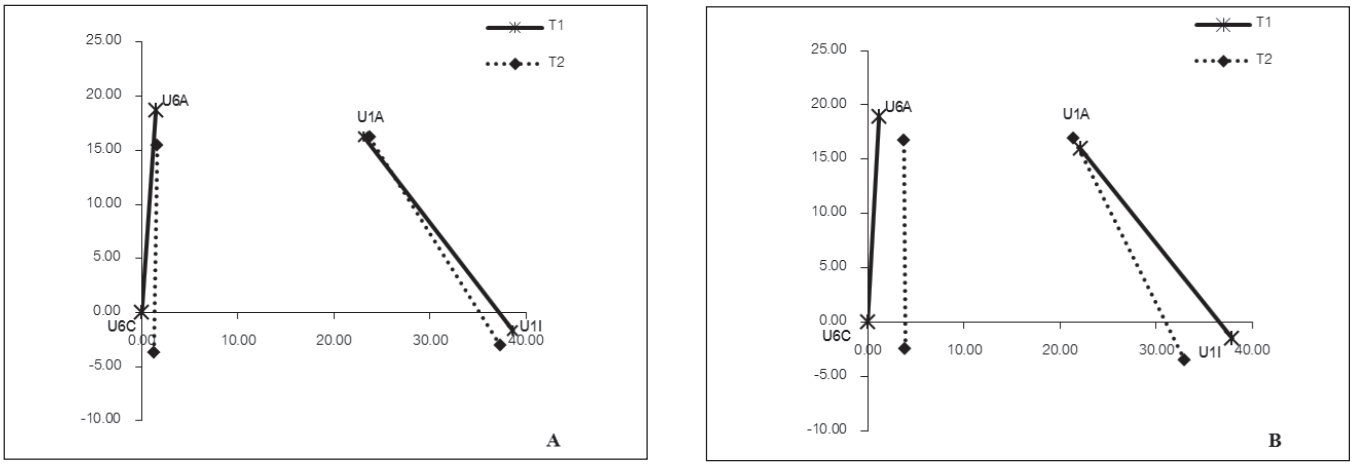

Fig. 6 *The displacement of maxillary incisor and first molar (A. non-extraction group, B. extraction group)*
X-axis: Downs' occlusal plane, Y-axis: perpendicular line at the mesiobuccal cusp of maxillary first molar
T1: pretreatment, T2: posttreatment

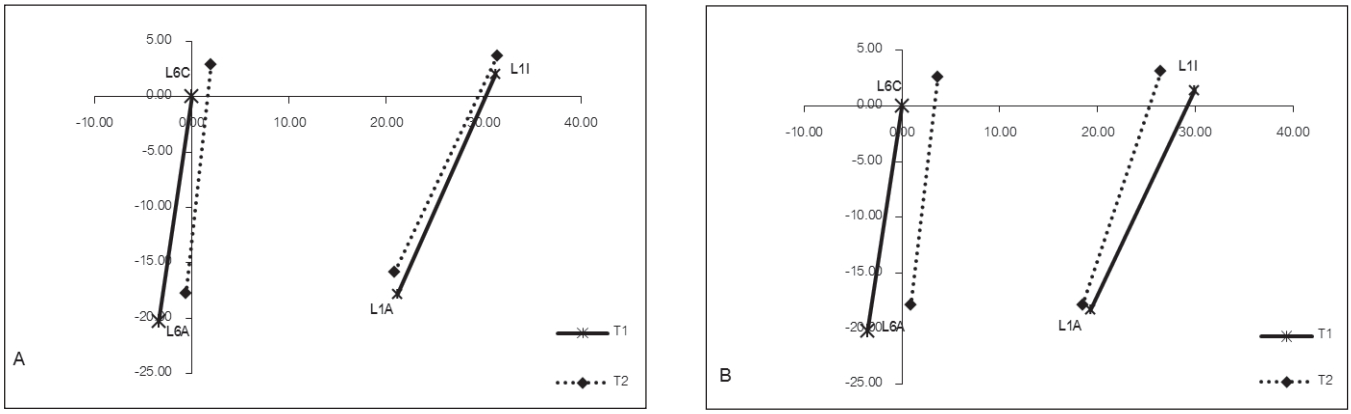

Fig. 7 *The displacement of mandibular incisor and first molar (A. non-extraction group, B. extraction group)*
X-axis: Downs' occlusal plane, Y-axis: perpendicular line at the mesiobuccal cusp of mandibular first molar T1: pretreatment, T2 : posttreatment

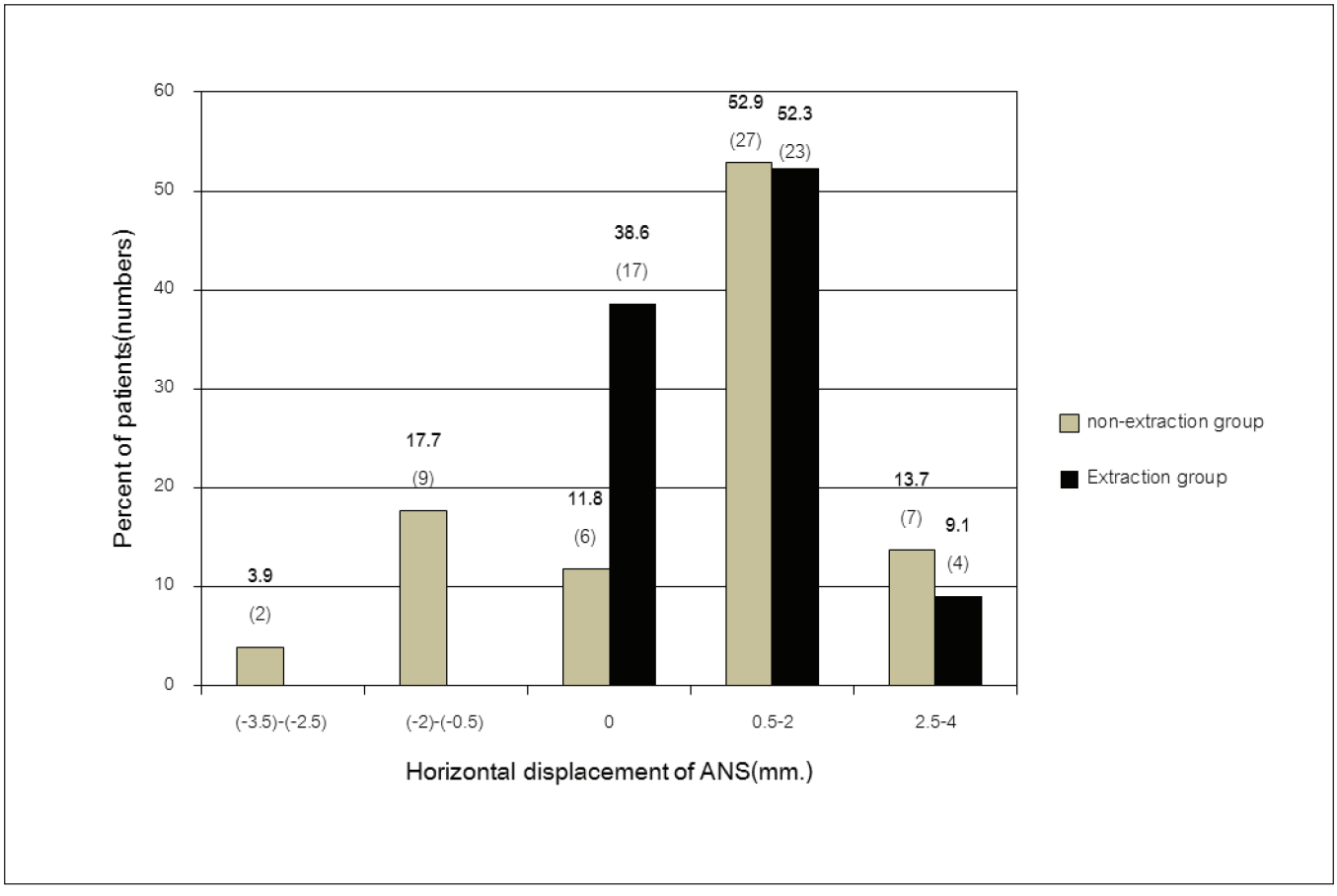

Fig. 8 *The horizontal displacement of ANS in non-extraction and extraction group*

Table 3 shows the skeletal, dental and soft tissue changes following the treatment of both groups. When compared, in the non-extraction group, the maxilla moved more downward significantly, the mandibular growth was enhanced inducing the anterior part of mandible to move more forward and downward significantly than those in the extraction group. In dental changes, in the non-extraction group, maxillary incisors (U1I) moved less backward and more slightly downward than the extraction group.

Table 3 *Changes of skeletal, dental and soft tissue profile between non-extraction and extraction group*

			Non-extraction group		Extraction group		
	Landmark (mm.)		**average**	**s.d.**	**average**	**s.d.**	**Significance**
1	**ANS**	**(x)**	0.68	1.60	0.85	1.01	ns
		(y)	-3.90	2.38	-2.50	1.69	**
2	**PNS**	**(x)**	-0.56	1.34	-0.65	1.08	ns
		(y)	-2.81	1.85	-1.83	1.45	**
3	**A**	**(x)**	0.20	1.48	0.17	1.15	ns
		(y)	-3.97	2.33	-2.85	1.55	**
4	**B**	**(x)**	1.57	2.31	0.11	2.42	**
		(y)	-7.82	3.26	-5.68	2.91	***
5	**Pog**	**(x)**	2.02	2.44	0.53	2.56	**
		(y)	-8.94	3.66	-6.99	3.23	**
6	**Me**	**(x)**	2.11	2.55	0.40	2.56	**
		(y)	-9.33	4.15	-7.30	3.39	*
7	**Ar**	**(x)**	-1.63	1.37	-0.99	1.68	*
		(y)	-1.97	1.75	-1.33	1.43	ns
8	**Go**	**(x)**	-2.05	2.21	-1.82	2.25	ns
	□	**(y)**	-7.88	3.44	-4.78	2.94	***
9	**U1I**	**(x)**	-1.30	1.76	-4.92	2.03	***
		(y)	-1.41	1.27	-2.06	1.70	*
10	**U1A**	**(x)**	0.57	1.66	-0.72	1.52	***
		(y)	-0.03	1.39	0.98	1.65	**
11	**U6C**	**(x)**	1.25	1.55	3.93	1.21	***
		(y)	-3.68	1.09	-2.40	1.36	***
12	**U6A**	**(x)**	0.15	1.96	2.58	1.55	***
		(y)	-3.22	1.14	-2.16	1.47	***
13	**L1I**	**(x)**	0.18	1.96	-3.45	2.67	***
		(y)	1.66	1.75	1.67	1.64	ns
14	**L1A**	**(x)**	-0.33	1.11	-0.82	1.22	*
		(y)	1.95	1.80	0.45	1.65	***
15	**L6C**	**(x)**	1.97	1.42	3.67	1.35	***
		(y)	2.90	1.44	2.64	1.39	ns
16	**L6A**	**(x)**	2.81	1.77	4.44	1.44	***
	□	**(y)**	2.55	1.50	2.39	1.55	ns
17	**LL-E line(mm.)**		-1.27	1.93	-2.92	1.96	*
18	**NLA(degree)**		5.67	8.68	4.03	7.74	ns

Significant between group *$p \leq 05$, **$p \leq .01$, ***$p \leq .001$; ns indicates not significant

1-16(x): positive values mean right on x-coordinate, negative values mean left on x-coordinate.

9-16(y): positive values mean above x-coordinate, negative values mean below x-coordinate.

Maxillary incisors apex (U1A) moved slightly forward and downward in the non-extraction group, whereas moved slightly backward and upward in the extraction group. Maxillary molars moved less forward and more downward in the non-extraction group. Mandibular incisors (L1I) moved slightly forward in the non-extraction group, whereas moved backward in the extraction group. Mandibular molars moved less forward and more upward in the non-extraction group. In soft tissue profile changes, lower lip of the extraction group was more retracted than those in the non-extraction group. Compared to the Thai norm, posttreatment soft tissue profile of both groups were in normal range.

Discussion

From the pretreatment characteristics, these Thai samples with Class II division 1 malocclusions had skeletal Class II malocclusion due to retrusive mandible with protrusion of incisors and lower lip. The non-extraction group had lower mean age and more severe skeletal problem (ANB angle), whereas the extraction group had more protrusion of incisors and lower lip. To control the bias from the experience of orthodontist, all samples in this study were treated by same orthodontist.

This study was decided to evaluate the treatment changes by regional superimposition method, this method can demonstrate the degree and direction of changes of each part of structures better than conventional linear and angular measurement that mostly used in the previous studies, therefore comparing the result of the treatment with other studies was limited.

Numerous studies have been undertaken to evaluate the efficiency of the cervical headgear in growing patients. Most of the previous studies emphasized the effect of this appliance on the maxillary growth; few studies had evaluated the effect on the mandibular growth. Therefore, this study aimed to evaluate the effect of cervical headgear especially on the mandibular growth and facial profile changes when compared with the extraction treatment.

Results from the study showed the effect of cervical headgear in treatment of Class II division 1 malocclusion patients on both maxilla and mandible. In the non-extraction group, ANS moved slightly forward (only 0.68 mm.), but moved downward 3.9 mm., A point moved only downward. Thus, the effect of headgear was redirecting the growth of maxilla into more downward direction.

Though the mean average showed the forward displacement of ANS in the non-extraction group, the individual response was varied, consisted of forward movement in 34 patients (66.67%), backward movement in 11 patients (21.6%) and no movement in 6 patients (11.8%). (Fig.8) In vertical plane, all sample showed the movement in same direction. Therefore the effect of cervical headgear on the maxilla was redirecting growth in more downward direction coincided with the previous studies.[2-5,14]

In the mandible, effect of cervical headgear combined with craniofacial growth enhanced the mandibular movement in both anterior and downward direction as described by other studies[7, 17,18] but is contrary to the finding of Kim and Muhl[19] who found no significant effect of cervical headgear on the mandibular growth. This might because the samples in that study were older (11.08$\pm$1.5 year olds) than in our study (10.51$\pm$1.33 year olds).

According to Keeling and coworkers' study,[7] the headgear, both cervical and high pull, showed significantly more skeletal Class II correction than did the controls with regard to mandible and apical base measures and caused posterior maxillary tooth movement. Lima Filho et al[17] suggested that cervical headgear was efficient in correcting the skeletal Class II relationship, most of the correction occurred as a result of anteriorly directed mandibular growth and the age at the onset of treatment was a critical factor. Baccetti et al[18] studied the effect of timing on the outcomes of non-extraction therapy and found that Class II malocclusion treatment before or during the pubertal growth spurt induced significant favorable skeletal changes by restricted maxillary advancement in pre-pubertal patients and enhanced mandibular growth in pubertal patients, patients treated after the pubertal growth spurt had only dentoalveolar changes. In this study, samples in non-extraction group did not passed the peak of pubertal growth which is the appropriate time to enhance the mandibular growth. However, the individual response of mandibular growth, in horizontal plane, to the cervical headgear was varied. The change of B point following the treatment was ranged from (-1.5) to 9.5 mm. (mean 1.57$\pm$2.31 mm.) (Table 3), the change of Pog point was ranged from (-1.0) to 11.5 mm. (mean 2.02$\pm$2.44 mm.), the change of Me point was ranged from (-1.0) to 11.5 mm. (mean 2.11$\pm$2.55 mm.) in the non-extraction group. The extraoral facebow of cervical headgeard tilted 20 degrees upward in relation to the occlusal plane as described by Melsen[14] who founded that the maxillary complex was rotated more posteriorly and molar was moved without tipping when the

extrabow was tiled upward because force vector passed closed to the center of resistance of tooth. In addition, the inner bow was expand to increase the intercanine width of the maxillary arch, this is essential for allowing the anterior displacement of the mandible.[17]

In comparison between the two groups, there were greater significantly skeletal changes in the non-extraction group than those in the extraction group, whereas dentoalveolar changes in horizontal direction were greater in the extraction group, indicated that correction of Class II malocclusion was accomplished mainly by orthopedic effect in the non-extraction group and by orthodontic effect in the extraction group. The extrusion of the molars following cervical headgear treatment coincided with the vertical growth of maxilla and mandible, as found in other studies,[3,20] might correct the dental deepbite thus allowing the mandible to grow into more anterior direction. The result showed some anterior movement of the maxillary first molar in non-extraction group that was consistent with the study by Cangialosi et al[20] but did not agree with conclusion of Haralabakis et al[3] and Keeling et al[7] who found posterior movement of the maxillary first molar following cervical headgear treatment. Anterior movement of the first molars in the non-extraction group might due to the leeway spaces after the exfoliation of deciduous molars that occurs during the treatment.

Lower lip was more retracted in the extraction group, but it is still acceptable when compared with the Thai norm, this agreed with the study of Bishara et al[12] who found that after treatment lower lips were more retrusive in the extraction group but contrast with James' study[11] who found that lip position was slightly more retrusive in the non-extraction group. There was no difference in upper lip retraction between groups. The upper lip position of both groups were in normal range of the Thai norm.

Conclusion

Our study of dentoskeletal and facial profile changes following the Class II division 1 treatment evaluated by lateral cephalometric radiograph had demonstrated that

1. Correction of Class II division 1 malocclusion was accomplished mainly by orthopedic effect in the non-extraction group and by orthodontic effect in the extraction group.

Cervical headgear was effective in treatment of Class II division1 malocclusion growing patients. Its treatment effects were redirection of the maxillary growth into more downward direction and enhancement of the mandibular growth in forward and downward directions.

2. Both treatment protocols had the favorable effect on the soft tissue profile.

References

1. Bishara SE. Class II Malocclusions : Diagnostic and Clinical Considerations with and without Treatment. ***Semin Orthod*** 2006;12:11-24.
2. Viteporn S. Maxillary Features following the Correction of Class II Division 1 Malocclusion with Cervical Headgear. ***J Dent Assoc Thai*** 1992;42:224-35.
3. Haralabakis NB, Halazonetis DJ, Sifakakis IB. Activator versus cervical headgear: superimpositional cephalometric comparison. ***Am J Orthod Dentofacial Orthop*** 2003;123:296-305.
4. Ciger S, Aksu M, Germec D. Evaluation of posttreatment changes in Class II Division 1 patients after nonextraction orthodontic treatment: cephalometric and model analysis. ***Am J Orthod Dentofacial Orthop*** 2005;127:219-23.
5. Kirjavainen M, Hurmerinta K, Kirjavainen T. Facial profile changes in early Class II correction with cervical headgear. ***The Angle orthodontist*** 2007;77:960-7.
6. Schiavon Gandini MR, Gandini LG, Jr., Da Rosa Martins JC, Del Santo M, Jr. Effects of cervical headgear and edgewise appliances on growing patients. ***Am J Orthod Dentofacial Orthop*** 2001;119:531-8; discussion 8-9.
7. Keeling SD, Wheeler TT, King GJ, Garvan CW, Cohen DA, Cabassa S, et al. Anteroposterior skeletal and dental changes after early Class II treatment with bionators and headgear. ***Am J Orthod Dentofacial Orthop*** 1998 Jan;113:40-50.
8. Proffit WR. Malocclusion and Dentofacial deformity in Contemporary Society. In: William R. Profit HWF, Jr.,Dav id M.Sarver, editor. Contemporary orthodontic. 4 ed. St. Louis, Missouri: Mosby Elsevier; 2007. p. 3-26.
9. Bowbeer GR. The 6th key to facial beauty and TMJ health. ***Funct Orthod*** 1987;4:10-1, 3-5, 8 passim.
10. Janson G, Fuziy A, de Freitas MR, Castanha Henriques JF, de Almeida RR. Soft-tissue treatment changes in Class II Division 1 malocclusion with and without extraction of maxillary premolars. ***Am J Orthod Dentofacial Orthop*** 2007;132:729 e1-8.

11. James RD. A comparative study of facial profiles in extraction and nonextraction treatment. ***Am J Orthod Dentofacial Orthop*** 1998;114:265-76.
12. Bishara SE, Cummins DM, Jakobsen JR, Zaher AR. Dentofacial and soft tissue changes in Class II, division 1 cases treated with and without extractions. ***Am J Orthod Dentofacial Orthop*** 1995;107:28-37.
13. Mathurasai W, Viteporn S. The relationship between the chronological age and the growth of the hand wrist bones in Thai at the age of 8-16. ***Journal of Graduate School Chulalongkorn University*** 1985;6:25-44.
14. Melsen B. Effects of cervical anchorage during and after treatment: an implant study. ***Am J Orthod*** 1978;73:526-40.
15. Nielsen IL. Maxillary superimposition: a comparison of three methods for cephalometric evaluation of growth and treatment change. ***Am J Orthod Dentofacial Orthop*** 1989;95:422-31.
16. Bishara SE, Athanasiou AE. Cephaolometric Methods for Assessment of Dentofacial changes. In: Athanasiou AE, editor. Orthodontic cephalometry. London: Mosby-Wolfe 1995. p. 105-24.
17. Lima Filho RM, Lima AL, de Oliveira Ruellas AC. Mandibular changes in skeletal class II patients treated with Kloehn cervical headgear. ***Am J Orthod Dentofacial Orthop*** 2003;124:83-90.
18. Baccetti T, Franchi L, Kim LH. Effect of timing on the outcomes of 1-phase nonextraction therapy of Class II malocclusion. ***Am J Orthod Dentofacial Orthop*** 2009;136:501-9.
19. Kim KR, Muhl ZF. Changes in mandibular growth direction during and after cervical headgear treatment. ***Am J Orthod Dentofacial Orthop*** 2001;119:522-30.
20. Cangialosi TJ, Meistrell ME, Jr., Leung MA, Ko JY. A cephalometric appraisal of edgewise Class II nonextraction treatment with extraoral force. ***Am J Orthod Dentofacial Orthop*** 1988;93:315-24.

บ ท วิ ท ย า ก า ร

การเปลี่ยนแปลงตำแหน่งของฟัน โครงสร้างใบหน้า และรูปหน้าด้านข้าง ภายหลังการจัดฟันด้วยวิธีการถอนฟันและไม่ถอนฟันในผู้ป่วย ที่มีการสบฟันผิดปกติชนิดที่ 2 แบบที่ 1

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บทคัดย่อ

การศึกษานี้มีวัตถุประสงค์เพื่อประเมินการเปลี่ยนแปลงตำแหน่งของฟัน โครงสร้างใบหน้า และรูปหน้าด้านข้าง ภายหลังการจัดฟันร่วมกับการถอนฟัน และการจัดฟันโดยไม่ถอนฟันร่วมกับการใช้เซอร์วิเคิลเฮดเกียร์ ในผู้ป่วยไทยที่มีการสบฟันผิดปกติชนิดที่ 2 แบบที่ 1 โดยประเมินจากการซ้อนทับภาพรังสีของผู้ป่วยไทยที่มีการสบฟันผิดปกติชนิดที่ 2 แบบที่ 1 จำนวน 95 คน ซึ่งได้รับการจัดฟันด้วยวิธีการไม่ถอนฟัน (51 คน อายุเฉลี่ย 10.5±1.3 ปี) และวิธีการถอนฟัน (44 คน อายุเฉลี่ย 11.8±1.3 ปี) และวิเคราะห์การเปลี่ยนแปลงของรูปหน้าด้านข้างจากมุมจมูก-ริมฝีปาก และระยะจากริมฝีปากล่างถึงระนาบสุนทรียะ ผลการศึกษา พบว่าเซอร์วิเคิลเฮดเกียร์มีผลปรับเปลี่ยนให้ขากรรไกรบนมีการเจริญในแนวดิ่งมากขึ้น และสามารถกระตุ้นการเจริญเติบโตในแนวระนาบและแนวดิ่งของขากรรไกรล่าง และพบการเปลี่ยนแปลงของโครงสร้างใบหน้าในกลุ่มตัวอย่างที่ไม่ถอนฟันมากกว่ากลุ่มตัวอย่างที่ถอนฟัน ในขณะที่การเปลี่ยนแปลงของฟันในแนวระนาบในกลุ่มตัวอย่างที่ถอนฟันมีมากกว่ากลุ่มตัวอย่างที่ไม่ถอนฟัน การถอนฟันช่วยลดความยื่นของริมฝีปากล่างได้มากกว่าการจัดฟันแบบไม่ถอนฟัน สรุปว่าการรักษาการสบฟันผิดปกติชนิดที่ 2 แบบที่ 1 โดยไม่ถอนฟันร่วมกับการใช้เซอร์วิเคิลเฮดเกียร์ เป็นการปรับเปลี่ยนการเจริญเติบโตของขากรรไกรบนและขากรรไกรล่าง ส่วนการจัดฟันด้วยการถอนฟันในระยะฟันถาวรมีผลเปลี่ยนแปลงตำแหน่งฟันมากกว่าโครงสร้างใบหน้า การรักษาทั้งสองวิธีมีผลปรับเปลี่ยนให้รูปหน้าด้านข้างภายหลังการรักษาสวยงามและอยู่ในเกณฑ์มาตรฐาน