The Effect of Asymmetrical V-bend on Dentoalveolar and Skeletal Changes among a Group of Growing Patients: A Cephalometric Study

ผลของวีเบนด์แบบไม่สมมาตรต่อกระดูกเบ้าฟันและโครงสร้างใบหน้าในคนไข้ที่ยังมีการเจริญเติบโต: การศึกษาในภาพถ่ายรังสี

Neeranart Thirasupa (นีรนาท ถิระศุภะ)* Dr.Chidchanok Leethanakul (ดร.ชิดชนก ลีธนะกุล)**

Dr.Udom Thongudomporn (ดร.อุดม ทองอุดมพร)***

ABSTRACT

The aim of this study was to investigate the effect of light-force partial fixed appliance with asymmetrical V-bend on mandibular rotation, the rotation of occlusal plane and the change of incisor and molar position. The subjects were composed of 10 hyperdivergent growing patients with anterior crossbite. The 2x4 fixed appliance were bonded and 0.016" SS wire with asymmetrical V-Bend were placed in the lower arch. The data was compared between prior to treatment and when lower incisors were intruded to the pre-determined level by Wilcoxon signed rank test at 0.05 level of significance. From cephalometric analysis, the lower incisors were significantly intruded and retroclined and the lower molars were significantly extruded and distally crown tipped which were beneficial to anterior crossbite and class III molar relationship correction. Although lower facial height was increased, the facial contour angle was maintained. Therefore, the patients' profile was not worsen.

บทคัดย่อ

วัตถุประสงค์ของงานวิจัยนี้เพื่อทดสอบผลของชนิดเครื่องมือติดแน่นบางส่วนที่ให้แรงขนาดเบาร่วมกับการใช้วีเบนด์แบบไม่สมมาตรต่อการหมุนของขากรรไกรล่าง, การหมุนของระนาบสบฟัน, การเปลี่ยนตำแหน่งของฟันตัดและฟันกราม กลุ่มผู้ป่วยคือผู้ป่วยที่ยังมีการเจริญเติบโต และมีโครงสร้างใบหน้าในแนวดิ่งแบบเปิด ร่วมกับมีฟันหน้าสบไขว้ขณะฟันสบสนิทจำนวน 10 คน การรักษาเริ่มต้นจากการติดเครื่องมือติดแน่นบางส่วนที่ขากรรไกรล่าง และกดฟันตัดล่างด้วยลวดเหล็กกล้าไร้สนิม หน้าตัดกลมขนาดเส้นผ่าศูนย์กลาง 0.016 นิ้ว ที่ดัดเป็นรูปวีเบนด์แบบไม่สมมาตร เปรียบเทียบข้อมูลภาพถ่ายรังสีก่อนทำการรักษาและหลังจากกดฟันตัดล่างจนถึงตำแหน่งที่ต้องการ ด้วยสถิติวิลคอกซันที่ระดับนัยสำคัญ 0.05 พบว่าฟันตัดล่างถูกกดลงและเอียงเข้าด้านใน ส่วนฟันกรามล่างถูกยกขึ้นและตัวฟันหมุนไปด้านหลังอย่างมีนัยสำคัญ ซึ่งผลเหล่านี้ส่งผลดีในการแก้ไขฟันหน้าสบไขว้และการสบฟันกรามประเภทที่สาม และแม้จะพบว่าผู้ป่วยมีความยาวใบหน้าเพิ่มมากขึ้น แต่ใบหน้าด้านข้างของผู้ป่วยไม่มีการเปลี่ยนแปลง

Key Words: Asymmetrical V-bend, Lower incisor intrusion, Anterior crossbite

คำสำคัญ: วีเบนด์แบบไม่สมมาตร การกดฟันหน้าล่าง ฟันหน้าสบไขว้

* *Student, Master of Science in Orthodontics, Department of Preventive Dentistry, Faculty of Dentistry, Prince of Songkla University*

** *Associate Professor, Department of Preventive Dentistry, Faculty of Dentistry, Prince of Songkla University*

*** *Assistant Professor, Department of Preventive Dentistry, Faculty of Dentistry, Prince of Songkla University*

Introduction

Anterior deepbite and deep curve of Spee can be orthodontically corrected by either lower incisor intrusion or posterior teeth extrusion or both (Burstone, 1977; Burstone, 2001). However, in hyperdivergent facial pattern patients whose faces are long and convex, anterior deepbite should be mainly corrected by lower inisor intrusion. This is to avoid worsening their profiles and facial heights.

An interesting alternative to intrude lower incisors is the use of asymmetrical V-bend advocated by Mulligan (1998). This technique simply requires partial fixed appliances and a bended archwire. To obtain pure intrusion force at lower incisors, the wire should be bent at two-third of interbracket span between permanent molar and lateral incisor with the longer part closed to the incisors. This technique is also called “Cantilever bend”. Intrusion of incisors by round archwire produces light and optimal force for intrusion but it possibly creates relative proclination of lower incisors which disadvantage to anterior crossbite patients. The wire, therefore, will be cinched back to control arch length and reduce chance of relative lower incisor proclination after intrusion.

Nevertheless, there have been few well designed studies on the effect of this technique. Divakar and Surendra (2001) compared forces produced from Mulligan’s intrusion technique with various other mechanics, consisting of Burstone’s intrusive arch, Mulligan intrusive arch and Ricketts intrusive arch. However, the posterior unit were prepared by heavy main archwire from canine to first molar which differed from original Mulligan technique and it was hard to applied in mixed dentition patients because of partial eruption of premolars or early loss of primary posterior teeth. Moreover, the study was done in laboratory which possibly differ from clinical situation. The effect of Mulligan intrusion mechanics on the lower arch among anterior crossbite patients whose anterior bite is free from occlusion is not known.

The objective of this study was therefore to investigate the effect of Mulligan intrusion mechanics on the lower dentition among a group of anterior crossbite patients

Objectives of the study

To investigate the effect of light-force partial fixed appliance with asymmetrical V-bend to

a. The alteration of mandibular rotation.
b. The rotation of occlusal plane.
c. The change of incisor and molar position in both vertical and horizontal dimension.

Methodology

Subjects

All of patients were explained about treatment step and willing to participate. When patients were qualified to be sample, they were invited to join the trial and the orthodontist provided the patients and parents both oral and written information of detail to study.

This study has been approved by Ethics committee on human experimental of Faculty of Dentistry, Prince of Songkla University. Ten growing patients attending the Orthodontic Clinic, Dental Hospital, Prince of Songkla University, who met the inclusion criteria were involved in the study. Consent was obtained from the parent of each patient. The patients’ inclusion criteria were anterior crossbite in maximum intercuspation on 2 or more incisors without traumatic occlusion or no need of emergency treatment, in pre-peak of pubertal growth spurt, hyperdivergent

growth pattern according to Archial analysis of Sassouni (1955), ANB angle in the range of 0 to 3 degree, lower incisors were intruded in the range of 2 to 3 mm from the visual treatment objective (VTO)

Methods

Patients were treated with 2x4 preadjusted edgewise fixed appliance in lower arch that consisting of brackets of permanent lower incisors with 0.018”x0.025” slot and permanent first molars buccal tubes with 0.022”x0.025” slot. Lower incisors were leveled and aligned until 0.016” diameter stainless steel wire and were colligated together. 0.016” diameter stainless steel wire with cantilever bend was used to intrude lower incisors. The wire was bent at two-third of interbracket span between permanent molar and lateral incisor with the longer part closed to permanent incisors. The angle between these two parts was 45 degrees which creates the force of 40 g, from laboratory experiment, to intrude lower incisors. Moreover, the wire was cinched back to control arch length and reduce chance of relative proclination of lower incisors after intrusion. The wire was changed to the new one if it became distorted.

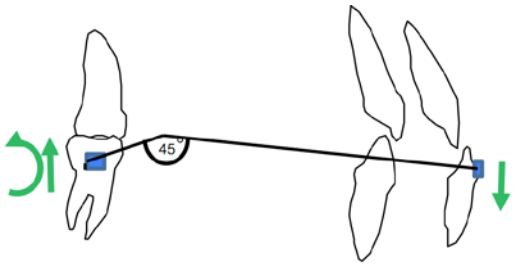

Fig.1 Partial fixed appliance with asymmetrical V-bend for lower incisor intrusion

To eliminate the chance of reciprocal molar extrusion effect, lowest optimum force to intrude lower incisors which is lesser than extrusion force of molars was applied and 40 g of force was the suitable intrusion force from previous literature reviews (Sadowsky & Sellke, 2000; Faber, 2002; Nanda & Kuhlberg 2005; van Steenbergen et al., 2005).

0.016” diameter stainless steel wire with cantilever bend in lower arch was applied until lower incisors were intruded to the planned level. After that, 0.017”x0.025” diameter stainless steel wire with passive utility arch was used to maintain position of lower incisors and molars and cephalometric result and model were analysed.

To obtain normal overjet, 0.016” diameter stainless steel wire with advancing loop was inserted in the upper arch to procline upper incisors after the research experiment was done.

Data records and analysis

The record was collected before the beginning of treatment (T_0) and after lower incisor intrusion was achieved (T_1). Each record comprised of lateral cephalometric radiograph and model. The model represented overjet, overbite, molar classification, change of incisor and molar position in vertical, sagittal and transverse plane.

Cephalometric analysis

Lateral cephalometric radiographs were taken in natural head position (Viazis, 1991) and all radiographs used in this study were taken from the same cephalostat and cephalometric x-ray machine. The tracing was done on acetate paper and reference points and lines were marked with 0.3 mm in diameter of mechanical pencil by one observer. All cephalograms were retraced and remeasured independently on 2 separate occasions with 4 week intervals. Method error (ME) in locating, superimposing, and measuring the changes of different landmarks will be calculated by Dahlberg’s formula

(Dahlberg, 1940) : ME = $\sqrt{\Sigma d^2/2n}$. The acceptable method error should not exceed 0.5 mm for linear variables and 0.5° for angular variables (Trpkova et al., 1997).

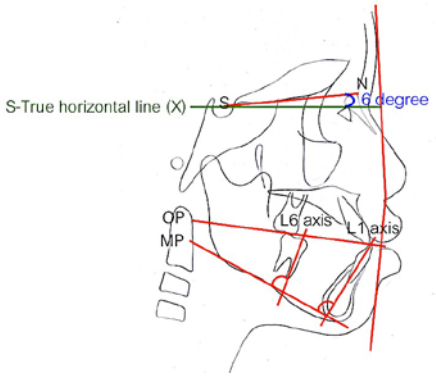

Fig.2 The cephalometric angular measurements

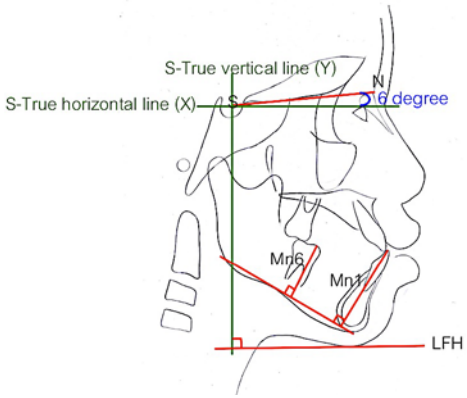

Fig.3 The cephalometric linear measurements

Statistical analysis

The statistical significance of the value between pre-treatment (T_0) and post-treatment (T_1) was performed. Mean and standard deviation (SD) of the total changes will be calculated for each cephalometric variables for descriptive analysis. The data was analyzed by Wilcoxon signed rank test. These statistic tools were considered at 0.05 level of significance.

Results

The samples comprised of 7 males and 3 females. Their mean age at the start of treatment was 9.4 ± 1.2 years. Maximum treatment duration was 6 months while the minimum was only 3 months. The average rate of lower incisor intrusion was 0.19 mm per month.

Table 1 Comparison of cephalometric value between Pre-treatment (T_0) and Post-treatment group (T_1)

Variable	Pre-treatment (T_0)		Post-treatment (T_1)		P value
	Mean	SD	Mean	SD	
Mn1-perpMP (mm)	39.0	2.5	38.1	2.4	.01*
Mn6-perpMP (mm)	28.2	1.7	29.4	1.7	.01*
LFH-S hor. (mm)	64.4	3.7	66.4	4.3	.01*
Overjet (mm)	-1.9	0.8	-0.2	2.3	.02*
Overbite (mm)	2.6	1.7	1.5	1.1	.00*
L1-MP (°)	89.1	3.9	85.8	5.4	.03*
L6-MP (°)	83.7	4.8	77.4	6.5	.02*
OP-S hor. (°)	11.2	4.7	11.9	4.1	.31
OP-MP (°)	18.9	3.8	18.5	4.5	.45
MP-S hor. (°)	30.2	5.0	31.1	5.3	.03*
FCA (°)	7.7	4.8	7.4	5.2	.37

* Statistical significance at p<0.05 level

The treatment effects of asymmetrical V-Bend were shown in Table 1. The lower incisors were intruded about 1 mm from initial position and were retroclined about 3 degrees with statistical significance while the lower molars were significantly extruded, 1.2 mm, and distally crown tipped, 6.3 degrees, as well. There was significant increase of lower facial height and angle between mandibular plane to S-True horizontal plane but the facial contour angle was maintained. The angle between occlusal plane to S-True horizontal line and to mandibular plane was

increased 0.7 degree and decreased 0.4 degree respectively but no statistical significance.

Discussion and Conclusions

Although the lower incisors seemed to be minimally intruded about 1 mm within 6 months, it has to be kept in mind that the figure was the net effect of mechanical intrusion subtracting from vertical dentoalveolar growth of about 0.8 mm per year (Alexander et al., 2009). Hence, the total intrusion from this study should be around 1.4 mm within only 6 months. Another satisfied result was the retroclination of lower incisors as a result of archwire cinch back. This effect benefit to anterior crossbite patients because it can correct deepbite and negative overjet simultaneously. In similar way, the crown of lower first molars were tipped back so the class III molar relationship was improve after treatment.

The functional occlusal plane angle did not change significantly. It can refer that extrusion of lower molars had no effect on occlusal plane which should not differ in openbite patients.

From the treatment result, lower molars were extruded and lower facial height was increased significantly that possibly came from distal crown tipping of lower molars. The increase of facial height and lower molar extrusion was about 1 and 2 mm respectively from initial and it was minimal clinically significant. Moreover, these consequences might be a result of mechanic or growth of the patients so the comparison to the control group should be done to confirm in further study. Although the lower facial height was increase, the facial contour angle was maintained. Therefore, the convex profile of these patients was not worsen.

Conclusion

Intrusion of lower incisors with partial fixed appliance with asymmetric V-Bend can be done effectively. Lower incisors were also retroclined and lower molars were distal crown tipping which advantage to anterior crossbite correction. The comparison of treatment group and control group should be further evaluated to assess that increased lower anterior facial height and lower molars extrusion are due to mechanic or the patients' growth. In addition, the sample should be larger to increase the chance of finding a significant difference.

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