The Lower Incisor Intrusion Technique Using an Archwire with L Loops in Correcting Class II Malocclusion with Deepbite

วิธีการกดฟันหน้าล่างด้วยลวดวงรูปตัวแอลในการแก้ไขการสบลึกในผู้ป่วยสบฟันผิดปกติประเภทที่ 2

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ABSTRACT

In class II malocclusion patients who have a deepbite and lack an incisal stop, supraeruption of lower incisors usually presents. The new lower incisor intrusion technique using an archwire with L loops was developed to prevent these side effects. Six patients (3 males and 3 females) were treated with fixed orthodontic appliances, after leveling they were aligned with the passive step up at the canine and lower incisors; a 0.017" x 0.025" TMA with L loops mesial to lower first premolars was used to intrude on the lower canine and lower incisors by loop activation and step up reduction until flat on the lower occlusal plane simultaneously.The superimposition of lateral cephalograms before and after treatment evaluated the difference of the treatment effects, using the Wilcoxon sign-rank test. The lower incisors were significantly intruded by 2.4±0.7 mm. There was no change of inclination of lower incisor and extrusion of the posterior teeth.

บทคัดย่อ

ในผู้ป่วยสบฟันผิดปกติประเภทที่ 2 ที่มีการสบลึกและไม่มีจุดหยุดปลายฟันหน้าล่าง มักพบลักษณะเฉพาะของการงอกเกินของฟันหน้าล่าง การใช้ลวดกดฟันร่วมการดัดวงรูปแอลถูกพัฒนาขึ้นเพื่อลดผลข้างเคียงเหล่านี้ ทำการศึกษาในผู้ป่วย 6 ราย (ชาย 3 คนและหญิง 3 คน) โดยเครื่องมือจัดฟันชนิดติดแน่น ปรับระดับฟันด้วยลวดดัดขั้นยกแบบไร้แรงบริเวณฟันเขี้ยวและฟันหน้าล่าง กดฟันหน้าล่างด้วยลวดทีเอ็มเอขนาด 0 .017x0.025 นิ้ว ดัดรูปตัวแอลหน้าต่อฟันกรามน้อยซี่ที่ 1 ปรับลวดรูปตัวแอลกระตุ้นการกดฟันเขี้ยวลงแล้วลดระดับขั้นยกฟันหน้าล่างจนได้ระดับการสบฟันล่างเรียบ ประเมินผลการรักษาจากผลต่างการซ้อนทับภาพถ่ายรังสีก่อนและหลังการกดฟันด้วยสถิติวิลคอกสัน ผลการศึกษาพบว่าฟันหน้าล่างถูกกดลงอย่างมีนัยสำคัญทางสถิติ 2.4±0.7 มิลลิเมตร ไม่พบการเปลี่ยนแปลงความเอียงของฟันหน้าล่างและการยกตัวของฟันหลัง

Key Words: Lower incisor intrusion, L loop, Class II malocclusion

คำสำคัญ: การกดฟันหน้าล่าง วงรูปตัวแอล การสบฟันผิดปกติประเภทที่ 2

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Introduction

Deepbite can be treated orthodontically by intrusion or flaring of the incisors, extrusion or passive eruption of the buccal segments, or a combination of these. Intrusion of the maxillary incisors is not indicated in patients with normal incisal display and with normal or long lower facial height (Varlik, Alpakan, and Turkoz, 2013) but in class II malocclusion patients with deepbite and a large overjet lacking an incisal stop, supraeruption and a more retruded position of lower incisors particularly presented, especially in growing children (Jones, 1966, Buschang, Julien, Sachadeva and Demirjian, 1992). The lower incisors intrusion technique is one of the treatment strategies correcting this problem using an utility arch, a Burstone ´s intrusive arch (Burstone, 1977, 2001), a Connecticut intrusive arch (Nanda, 2005), a reverse curve of Spee arch wire (Hong, Hong and Koh, 2001), and a step down arch wire etc. Therefore many treatment modalities exist including for posterior teeth extrusion but a side effect is that it causes the mandible to rotate clockwise more in class II patients or else it proclines the lower anterior teeth instead of pure intrusion.

The side effects from many previous studies might come from the design of the intrusion technique and activation**.** From the study of Aydogdu and Ozsoy in 2011 and Varlik, Alpakan and Türköz in 2013 using an utility arch for intruded lower incisors, it showed that there was posterior teeth extrusion 0.8-1.2 mm and lower incisors were proclined at 0.6-8˚. The posterior teeth extrusion particularly came about from the reciprocal extrusion force at the buccal segment during anterior teeth intrusion and flaring of lower incisors was due to an anterior point of force application in front of the center of resistance. Those adverse effects might come from the high intrusive force of intrusion. The optimal force levels that could be used to intrude the lower incisors are about 40-80 g. (Ricketts, 1976; Proffit, 2007; Nanda, 2005; Nanda and Tosun, 2010). The design of a step bend in a rectangular arch wire was used for many years to resist proclination and control the lower teeth angulation during treatment. In addition, L loop is one of the design that would being adjusted and activated to move downward the opposite portion of the L loop. Moreover, the study of Rabound, Faulkner, Lipsett and Haberstock in 2001 found that an asymmetrical loop design could differentiate the force reaction on the higher or lower side from an uneven length of loop distance. Developing a new technique from this knowledge and well-design treatment sequence could produce a pure intrusion and this is the purpose of this study.

Objectives of the study

1. To develop a technique for lower incisor intrusion without posterior teeth extrusion.
2. To present the treatment effects of this technique on the lower incisors and lower first molars.

Materials and Methods

The 30 samples were selected from the orthodontic clinic at the dental hospital, Faculty of dentistry, Prince of Songkla University. The inclusion criteria for this study were:

- Deepbite > 4 mm.
- Skeletal class I or class II malocclusion with hypodivergent or normodivergent pattern.

- Growing status indicated Cervical Vertebrae Maturation Index (CVM) stage 3-4 (Ball , Tompson, Hunter and Posluns, 2011)

- Good general health, no underlying disease

All the patients and their parents were informed about the purpose of the study and signed the consent form. This study was accepted by the ethics committee of the Faculty of Dentistry, Prince of Songkla University.

In this study, there were 6 patients (3 males and 3 females). The average initial age was 11.2 ± 1.2 years, ranging from 10-13 years. The lower incisors were intruded until flat on the occlusal plane. The treatment time of the lower incisors intrusion was 5.5± 1.2 months.

The patients were treated with preadjusted edgewise fixed appliances as per Roth 's prescription, being a bidimensional technique (with 0.018 x 0.025 inches slot size at the lower incisors and 0.022 x 0.028 inches slot size at the lower canine and posterior teeth). The lower teeth were bonded and being aligned with round NiTi wire until finished with 0.016"x 0.022" NiTi wire with the passive 2 step up, at the lower canine and lower incisor regions, to keep the curve of Spee before intrusion. 0.017"x 0.025" wire with L loops mesial to the right and left lower first premolars and passive step up at the lower incisors was placed for intrusion technique as shown in Fig 1. The patients were recalled for routine checks every 4 weeks. The arch wires were adjusted at the L loops to intrude lower canines 1 mm./visit until achieving the same level as the lower first premolars (the force level is 55-60 grams approximately) and then reducing the step up of lower incisors simultaneously every visit until achieving flat a curve of Spee.

Fig. 1 A lateral cephalogram before intrusion (T1).

The analysis of the treatment effects was derived from cephalogram tracing. The registrations from the lateral cephalograms were performed on acetate tracing paper. The comparison of the two lateral cephalograms were evaluated before and after intrusion (T1 and T2 respectively). The T1 cephlograms was shown as Fig. 2. All cephalograms were taken with the same calibrated cephalostat. The magnification factor of the lateral cephalograms was similar before and after intrusion. The measurement of each parameter was made with a digital vernier caliper. Linear measurements were made to the nearest 0.5 mm and 0.5^0 of angulation.

Reference lines

- MP (mandibular plane): the line through the menton to the lower border of the most posterior inferior of the angle of the mandible.

- ASP (anterior aspect of internal border of the symphysis plane): The line through the anterior border of the internal border of the symphysis perpendicular to the mandibular plane

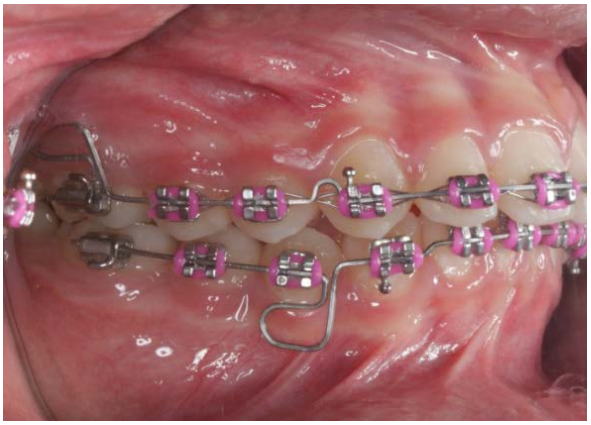

Fig. 2 A lower intrusion arch wire with L loops in this study.

Study Parameters

From tracing cephalometric radiographs, parameters were measured in distances and angles evaluated the movement of the lower incisor and the lower first molar horizontally and vertically, as shown on Fig. 3 with the following parameters:

- LIMP: The angle between the lower incisors and the mandibular plane

- LIi_Horizontal: The horizontal distance between the lower incisal tip perpendicular to the ASP

- LIi_Vertical: The vertical distance between the lower incisal tip perpendicular to the MP

- LIA_Horizontal: The horizontal distance between the lower incisal apex perpendicular to the ASP

- LIA_Vertical: The vertical distance between the lower incisal apex perpendicular to the MP

- L6i_Horizontal: The horizontal distance between the mesiobuccal cusp tip of the lower first molar perpendicular to the ASP

- L6i_Vertical: The vertical distance between the mesiobuccal cusp tip of the lower first molar perpendicular to the MP

- L6A_Horizontal: The horizontal distance between the mesial root apex of the lower first molar perpendicular to the ASP

- L6A_Vertical: The vertical distance between the mesial root apex of the lower first molar perpendicular to the MP The MP and ASP line from T1 cephalometric radiographs were used as a reference grid that was transferred to T2 cephalometric radiographs by superimposition registed at the anterior part of posterior and inferior internal border of cortex of the symphysis and mandibular plane.

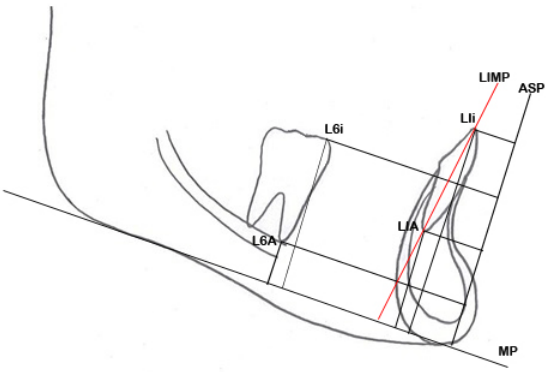

Fig. 3 Cephalometric landmarks, linear and angular measurement for evaluated treatment effects

All data was analyzed with the PSPP statistical program. The means and standard deviations were evaluated. The differences between the lower incisors and lower first molar movement before (T1) and after intrusion (T2) were evaluated by the Wilcoxon signed-rank test. The differences in probabilities of less than 5% ($P<0.05$) were considered statistically significant.

Result

From this intrusion technique, lower incisors intruded with statistical significance ($P= 0.03$), and the mean distance of the lower incisors intrusion was

2.4±0.7 mm. (Table 1). There was no statistically significant difference of the horizontal position and angulation, but the angulation of lower incisors was slightly retroclined by about 1.0±2.8 degree.

On the lower first molars, there was a little bit of movement in the vertical direction of the lower first molar by 0.1±0.2 mm. but no movement in the horizontal direction. This intrusion technique showed that there was no clinical and statistically significant movement of the posterior anchorage any direction as shown in Fig. 4.

Fig. 4 A lateral cephalogram after intrusion (T2).

Discussion

From other studies, even though where there were mechanics that controlled the posterior anchorage unit which enhanced the lower incisors intrusion in deepbite malocclusion, posterior teeth extrusion might have occurred.

By using this L-Loop intrusion technique, the amount of intrusion distance was similar to other studies but there was less side effects on posterior teeth extrusion because of the having L loop design in this technique. It differentiated with the lower extrusion force more than anterior intrusion force from the longer distance of the posterior leg and the lower amount of activation which reduced the reciprocal extrusion force. Aydogdu and Ozsoy in 2011 found that there was lower incisors proclination after treatment because the point of force application was applied in front of the center of resistance of the lower incisors and the initial angulation of the lower incisors were more proclined before treatment. However, in this study, the point of force application was still applied at the facial aspect of lower incisors, but the effect of the step bend from the L-loop activation could control and upright the lower incisors encountering this adverse effect on proclination during treatment.

Conclusion

This intrusion technique could intrude and retrocline lower incisors without adverse effect of posterior teeth extrusion.

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Table 1 Descriptive statistics of parameters before and after lower incisors intrusion

Parameters	Befor (T1)		After (T2)		T2-T1		Sig
	Mean	SD	Mean	SD	Mean	SD	
LIMP(°)	102.7	5.5	101.7	6.1	-1.0	2.8	.46
LIi_Horizontal(mm)	2.8	2.4	2.8	1.8	0.1	1.1	.85
LIi_Vertical(mm)	42.3	1.9	39.8	2.0	-2.4	0.7	.03*
LIA_Horizontal(mm)	7.8	0.6	7.3	1.4	-0.5	1.1	.29
LIA_Vertical(mm)	20.3	2.7	17.8	2.3	-2.5	0.7	.03*
L6i_Horizontal(mm)	30.1	0.7	30.1	0.7	0.0	0.0	1.00
L6i_Vertical(mm)	34.7	0.8	34.2	2.8	0.1	0.2	.32
L6A_Horizontal(mm)	30.1	1.8	30.1	1.8	0.0	0.0	1.00
L6A_Vertical(mm)	12.8	2.3	13.0	2.4	0.1	0.2	.32

*Significant value $P < 0.05$

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