A New Maxillary Molar Distalization and Extrusion System in Correction of Class II Malocclusion with a Non-compliance Method

ระบบการเคลื่อนฟันกรามบนไปด้านหลังและด้านบดเคี้ยวชนิดใหม่ที่ไม่ต้องอาศัยความร่วมมือของผู้ป่วยในการแก้ไขการสบฟันผิดปกติประเภทที่ 2

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ABSTRACT

Class II malocclusion with deepbite can be corrected by maxillary molar distalization and extrusion. The treatment effect of cervical pull headgear depends on patient's compliance and other appliances may cause anchorage loss. So the new maxillary molar distalization and extrusion system was developed for a non-compliance method. Seven patients (2 male and 5 female) were treated with fixed orthodontic appliances where the anchorage was prepared by upside down bonded upper incisor brackets and uprighting springs. The upper molars were distalized and extruded by a 0.017"x 0.025" TMA wire with L loops. The lateral cephalometric films were measured to compare the difference between before and after upper molar distalization and extrusion, using the Wilcoxon signed-rank test. The upper molars were significantly distalized 2.93±0.35 mm. and extruded 1.32± 0.43 mm. with no anchorage loss. The rate of upper molar distalization and extrusion were 0.89±0.18 and 0.49± 0.17 mm. per month, respectively.

บทคัดย่อ

วิธีการแก้ไขการสบฟันผิดปกติประเภทที่ 2 ที่มีการสบลึก ได้แก่ การเคลื่อนฟันกรามบนไปด้านหลังและด้านบดเคี้ยว การใช้เฮดเกียร์ต้องอาศัยความร่วมมือของผู้ป่วยและเครื่องมือชนิดอื่นๆมีผลทำให้สูญเสียฟันหลักยึด ผู้วิจัยจึงได้ประดิษฐ์ระบบการเคลื่อนฟันกรามบนไปด้านหลังและด้านบดเคี้ยวชนิดใหม่ที่ไม่อาศัยความร่วมมือของผู้ป่วยขึ้น ทำการศึกษาในผู้ป่วย 7 ราย (ชาย 2 คนและหญิง 5 คน) โดยเครื่องมือจัดฟันชนิดติดแน่นประกอบด้วยการเตรียมหลักยึดด้วยแบรคเก็ตกลับหัวที่บริเวณฟันหน้าบนและสปริงตั้งรากฟัน เคลื่อนฟันกรามบนโดยลวดทีเอ็มเอขนาด 0.017x0.025นิ้วดัดเป็นรูปตัวแอล ทำการศึกษาในภาพรังสีกะโหลกศีรษะด้านข้าง เปรียบเทียบการเปลี่ยนแปลงก่อนและหลังการเคลื่อนฟันกรามบนด้วยสถิติวิลคอกสัน ผลการศึกษาพบว่าฟันกรามบนถูกเคลื่อนอย่างมีนัยสำคัญทางสถิติไปด้านหลังเท่ากับ 2.93±0.35 มิลลิเมตรและด้านบดเคี้ยว 1.32± 0.43 มิลลิเมตร ไม่พบการสูญเสียหลักยึดโดยมีอัตราการเคลื่อนที่ไปด้านหลังและด้านบดเคี้ยวเท่ากับ 0.89±0.18 และ0.49±0.17 มิลลิเมตรต่อเดือนตามลำดับ

Key Words: Maxillary molar distalization and extrusion, Class II malocclusion

คำสำคัญ: การเคลื่อนฟันกรามบนไปด้านหลังและด้านบดเคี้ยว การสบฟันผิดปกติประเภทที่ 2

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Introduction

Regarding class II malocclusion patients with deep overbite, the proper treatment plans are a combination of anteroposterior and vertical malocclusion correction. Maxillary molar distalization and extrusion is one of the successful treatments that can correct class II malocclusion to a dental class I relationship with bite opening mechanics.

Several treatment modalities exist for distal movement of maxillary molars. Cervical pull headgear is an acceptable appliance and commonly used but the treatment success depends on the patient's compliance. (Cureton et al., 1993)

In recent years, many non-compliance appliances have been invented such as a Pendulum (Ghosh & Nanda, 1996), a Jones jig (Brickman et al., 2000) and open coil springs (Gianelly et al., 1991). However, these intraoral appliances do not move only the maxillary molars, but also the upper premolars and anterior teeth, which are the anchorage.

To enhance anchorage control, these appliances have to cooperate with some components such as the Nance button and transpalatal arch. Consequently, orthodontists or technicians have to deal with many steps of laboratory procedures in constructing these appliances.

Therefore, the new system of maxillary molar distalization and extrusion has been developed without the need for laboratory preparation and patient compliance.

Objective of the study

To develop a new system for distalizing and extruding maxillary molars with no need for patient co-operation and laboratory procedures.

Methodology

7 patients (2 male and 5 female) were selected from the orthodontic clinic of the dental hospital of the faculty of dentistry, Prince of Songkla University.

The inclusion criteria are as follows:

- Good general health, no underlying disease
- Molar class II relationship with deep overbite
- Skeletal class I or class II relationship with hypodivergent or normodivergent pattern
- During the MP_3 stage (maximal pubertal growth status has not yet been reached), the patients were assessed by hand & wrist radiographic examination.

All patients and their parents signed a consent form after they were informed about the purpose of the study and the steps of treatment. This study was proved and accepted by the ethics committee of the faculty of dentistry, Prince of Songkla University.

The patients were treated with the Roth's prescription preadjusted edgewise bracket system. Upper incisors were upside down bonded with incisor brackets. After aligning and leveling, a 0.017"x0.025" TMA wire with L loops and the uprighting springs were placed. The patients were recalled for routine checks every 4 weeks. The archwire was readjusted and reactivated until the patients' occlusion was overcorrected in a molar class III relationship of 1 mm.

To evaluate the treatment effects of this system, a comparison of two lateral cephalometric radiographs were evaluated between a T1 film

(before distalization and extrusion of maxillary molars) and a T2 film (after obtaining dental class III relationship of 1 mm.). All radiographs were taken with the same cephalostat (Orthophos® CD, Siemens, Germany). The magnification factor of the lateral cephalograms was similar before and after molar distalization and extrusion. The tracings were done on acetate paper and then reference points and lines were marked with 0.3 mm in diameter spacing with a mechanical pencil by one observer to avoid interoperate errors. The measurement for each variable was made with a cephalometric protractor. Linear measurements were made to the nearest 0.5 mm and 0.5° of angulation on acetate tracing paper.

The cephalometric systems described by Pancherz (Pancherz, 1982) are used and modified to analyze the treatment effects. The reference lines and the measuring points used for measurement are as follow:

Reference lines

- OL (occlusal line): A line through the incisal tip of the maxillary incisor (is) and the distobuccal cusp of the maxillary permanent first molar.

- OLp (occlusal line perpendicular): A line perpendicular to OL through Sella.

- PP (palatal plane): A line through the anterior nasal spine and the posterior nasal spine.

Measuring points

- ms (molar superius) : The mesial contact point of the maxillary prominent first molar.

The measuring points, reference points and reference lines are defined in figure 1.

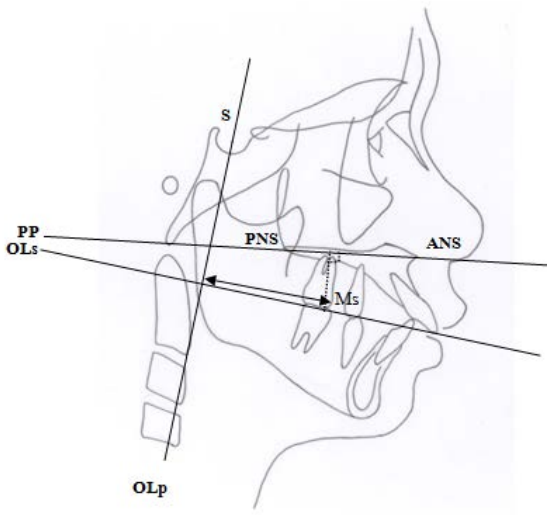

Figure 1 Cephalometric landmarks for investigating treatment effects; horizontal measurements (arrow line) and vertical measurements (dot line)

The occlusal line perpendicular (OLp) to the T1 cephalograms was used as a reference grid that was transferred to T2 cephalograms by superimposition of tracings on the midsagittal cranial structure.

From the tracing, variables measured in distances indicated the movement of upper first molar horizontally and vertically.

All data was analyzed with a PSPP statistical program. The mean and standard deviation (SD) were calculated for all cephalometric variables. The means of cephalometric variables before distalization and extrusion are T1 and after variables are T2 .The means in difference were compared before and after distalization and extrusion by the Wilcoxon-signed rank test at an alpha significance level of 0.05.

Results

In this study, there were 7 patients (2 male and 5 female) who participated and finished the investigation. The mean initial age was 12.14± 1.57

years, with a range from 10 to 14 years. The upper molars were distalized to an overcorrected class III molar relationship of 1 mm. Treatment time for upper molar distalization and extrusion was 3.36±1.48 months and 2.86±0.90 months, respectively.

The mean distance of upper molar distalization was 2.93±0.35 mm. and they extruded 1.32±0.43 mm. The rate of upper molar distalization and extrusion were 0.89±0.18 and 0.49±0.17 mm. per month, respectively.

There was a statistically significant difference (P=0.01) between the horizontal and vertical position of the upper molars before and after distalization and extrusion phases.

Table1 Descriptive statistics of cephalometric measurements before and after molar distalization and extrusion

Measurements	Before (T1)		After(T2)		T2-T1		Sig
	Mean	SD	Mean	SD	Mean	SD	
6-OLp(mm.)	55.14	3.75	52.21	3.76	-2.93	0.35	0.016*
6-PP(mm.)	23.36	0.94	24.68	1.05	1.32	0.43	0.017*

**P=0.01*

Discussion

Molar distalization is one of the treatment strategies that correct dental class II malocclusion back to a dental class I relationship. In cases of hypo- or normodivergent patients, molar extrusion can improve deepbite. Several methods have been developed in molar distalization including cervical pull headgear (Melson, 1978), a Pendulum (Ghosh & Nanda, 1996), a Jones jig (Brickman et al, 2000) and open coil springs (Gianelly et al., 1991). However, many problems have been reported with these appliances such as patient non co-operation, discomfort, and anchorage loss (Sfondrini et al., 2002).

The aim of this study is to develop a new system to distalize and extrude maxillary molars with no need for patient co-operation and no need for laboratory procedure.

From this study, the upper molars were distalized 2.93 mm. and extruded 1.32 mm. during 3.36 and 2.86 months. The rate of molar distalization and extrusion were 0.89 and 0.49 mm. per month, respectively. In previous studies, cervical pull headgear moved the upper molar posteriorly 3-4 mm. and occlusally 1-1.5 mm. during 10-11 months (Taner et al., 2003; Haydar & Uner, 2000), other study reported that the rate of molar distalization was 0.34 mm. per month (Gandini et al., 2001). So when comparing this new system with cervical pull headgear, the new maxillary molar distalization and extrusion system can move the upper molar distally and occlusally more than the cervical pull headgear in a shorter period of time without the need for patient co-operation.

Other intra-oral appliances such as a Pendulum can move molars distally 2.8 mm. during 2.5 months (Haydar & Uner, 2000). The Jones jig moved the maxillary molars 2.78 mm. distally within 3 months. (Gulati et al., 1998) The rate of molar distalization from a Pendulum varies from 0.6-0.8 mm. per month (Ghosh & Nanda, 1996; Byloff & Darendeliler, 1997; Fuziy et al., 2006) while a Jones jig could move a molar distally at the rate of 0.86 mm. per month (Gulati et al., 1998). Comparing the distance and rate of molar distalization, our system can move upper molars distally over a similar distance to other appliances and with better rate of tooth movement.

The proper treatment of class II malocclusion with a hypodivergent pattern is molar distalization and extrusion, which can increase the lower facial height. However, when molars are distalized and extruded, a clockwise rotation of the mandible will be observed and the chin will look more retruded. So molar distalization is a treatment strategy that is not suitable for a hyperdivergent facial pattern (Bowman, 1998).

Molar distalization tends to rotate the mandible downward and backward as well as increase the mandibular plane angle (Gulati et al., 1998). However, the mandible would return to the initial sagittal and vertical position, reflecting the inherited growth individual pattern (Angelieri et al., 2006). So the remaining growth after molar distalization is indicated in the patient and a forward rotation of the mandible will be observed (Kim & Muhl, 2001).

Conclusion

A new maxillary molar distalization and extrusion system can effectively correct class II malocclusion with deepbite. The upper molars were significantly distalized and extruded. Molar class II malocclusion was corrected to a dental class I relationship.

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