การถอนฟันกรามคุดล่างซี่ที่สามทางทันตกรรมจัดฟัน โดยใช้หมุดเกลียวขนาดเล็กสำหรับงานทันตกรรมจัดฟัน

Orthodontic Extraction of Impacted Mandibular Third Molar Teeth using Miniscrew Anchorage

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บทคัดย่อ

การใช้แรงทางทันตกรรมจัดฟันเพื่อช่วยในการถอนฟัน โดยร่วมกับการใช้หมุดเกลียวขนาดเล็กทางทันตกรรมจัดฟัน สามารถช่วยลดความเสี่ยงของภาวะแทรกซ้อนที่เกิดขึ้นในการถอนฟันกรามคุดล่างซี่ที่สามที่ฝังในตำแหน่งลึกได้ อย่างไรก็ตามประโยชน์ และประสิทธิภาพของวิธีการนี้ยังไม่ได้มีการศึกษาในด้านอัตราการเคลื่อนที่และวัดปริมาณของการตั้งฟันกรามคุดล่างซี่ที่สาม

การวิจัยนี้เป็นการวิจัยเชิงวิเคราะห์แบบไปข้างหน้าจากเหตุไปหาผล โดยใช้ฟันคุด (ฟันกรามแท้ซี่ที่สามที่มีลักษณะล้มเอียงไปทางด้านใกล้กลางและล้มเอียงไปในแนวระนาบ) จำนวน 20 ซี่ ซึ่งจำเป็นต้องถอนออกระหว่างการจัดฟัน โดยใช้สปริงตั้งฟันทางทันตกรรมจัดฟันโดยร่วมกับการใช้หมุดเกลียวขนาดเล็กเดี่ยวทางทันตกรรมจัดฟัน และใช้ภาพรังสีพานอรามิกทุกเดือนตั้งแต่เริ่มต้น จนจบการใช้สปริงตั้งฟันทางทันตกรรมจัดฟัน ในการประเมินองศาของฟันกรามล่างแท้ซี่ที่สามที่เปลี่ยนไปในแต่ละเดือนโดยเปรียบเทียบกับแนวแกนฟันกรามล่างแท้ซี่ที่สอง หลังจากตั้งฟัน ฟันทุกซี่ถูกถอนออกด้วยวิธีการถอนฟันอย่างง่าย

ผลการศึกษาพบว่าระบบการใช้สปริงตั้งฟันทางทันตกรรมจัดฟันโดยร่วมกับการใช้หมุดเกลียวขนาดเล็กเดี่ยวทางทันตกรรมจัดฟัน ในฟันกรามคุดล่างซี่ที่สามได้อย่างมีประสิทธิภาพ ทั้งระยะเวลาเฉลี่ย,ปริมาณการตั้งฟัน และ อัตราเฉลี่ยองศาต่อเดือน ตามลำดับ โดยไม่พบอาการแทรกซ้อนที่รุนแรงแต่อย่างใด

คำสำคัญ: วิธีช่วยถอนฟันด้วยการใช้แรงจัดฟัน, ฟันกรามแท้ซี่ที่สาม, การตั้งฟัน, หมุดเกลียวขนาดเล็กทางทันตกรรมจัดฟัน

Abstract

The orthodontic extraction technique (OE) with miniscrew implant anchorage minimizes the risk of complications from the removal of deeply impacted

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Conclusions, Discussion, and Recommendations

All patients had had their iM8 simply extracted (2.5 ± 3.5 minutes) following OE without any complication. No IAN injury, no postoperative pain nor complications were observed. An average of 4.1 ± 1.25 months was necessary to upright the iM8s. Although the average rate of iM8s movement was 11.0 ± 4.2 degrees/month, there was a progressive increase in the rate throughout the treatment. In the first month, the initial rate of iM8 movement was 5.1 ± 3.0 degrees/month, followed by 10.6 ± 5.7, 14.8 ± 6.3 and 14.1 ± 10.2 degrees/month in the following months, respectively.

Our results demonstrated that in the first month, there was less movement which the initial rate of tooth movement and became linear increasing in rate of tooth movement. Although, to the best of our knowledge, this is the first study that demonstrates the rate and amount of the iM8 OE technique with miniscrew. This is consistent with overall orthodontic movement about the phase of tooth movement which described by Burstone (Burstone, 1962) about the rates of tooth movement, there were three phases of tooth movement: Initial phase, lag phase, and post lag phase, respectively.

Our orthodontic tooth uprighting for facilitated tooth extraction is relatively safe which avoids the complications of the surgery, especially inferior alveolar nerve injury in agreement with other studies.(Bonetti et al., 2008; Checchi et al., 1996; Montevecchi et al., 2014) In the study of Bonetti et al, more than 80 patients were successfully treated using OE without IAN complications. Moreover, Clinical cases of this technique have shown a great advantage at periodontal aspect at adjacent second molar by the effect of orthodontic extrusion.

In our study, most of the cases showed 45 degrees of uprighting gained in about 4 months which transforms difficult impacted third molar surgery to a simple extraction. Orthodontic extraction (OE) technique with miniscrew supported Smart Springs allows a simple and safe extraction of iM8s. This OE method can be an important alternative treatment option to avoid postoperative discomfort and complications.

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Table 1 A summary of the degrees, durations, and rate of tooth movement for uprighting in the OE group

Parameter	OE group (N=20)	
	Mean	SD
Treatment Duration (months)	4.1	1.2
Initial Angulation: M7/M8 (angle)	63.6	18.1
Total Amount of Angulation change (angle)	44.4	15.7
Rate of Angulation change (degree/month)	11.0	4.2
Patient age	23.9	4.3

The mean duration of tooth movement was 4.1 ± 1.2 months, and the mean rate of tooth movement was 8.3 ± 1.2 degrees per month. The reduction of angulation was significantly and strongly correlated with an increase in the duration of orthodontic uprighting (r=0.63; p=0.011)

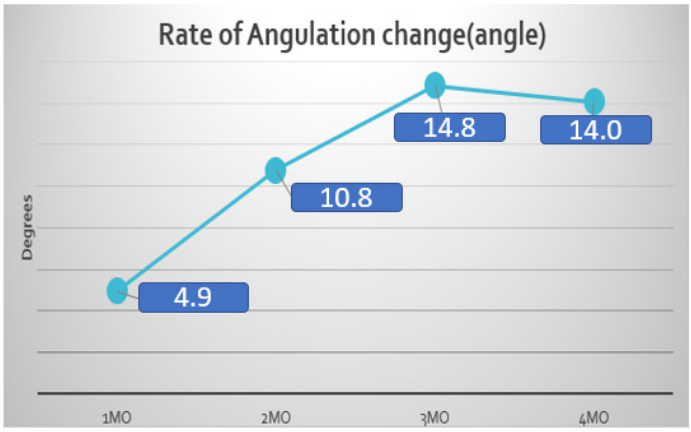

Fig 4 Progressive increase in the rate of iM8 uprighting throughout treatment

The reduction of angulation was significantly and strongly correlated with an increase in the duration of orthodontic loading

Using the mandibular plane as a reference line, the angulation changes in M7s between iM8 were obtained and the position changes in the iM8s and M7s were measured from the tooth displacement (Figure 2).

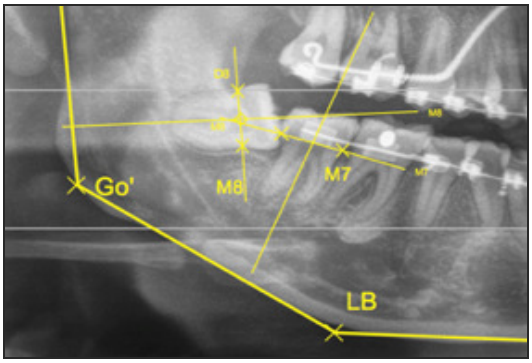

Fig 2. Measurement on panoramic radiograph.

Research Results

The transverse discrepancy was corrected in all cases (Fig 3) in 4.2 ± 1.1 months. Of the seventeen cases, four cases were treated with unilateral maxillary expansion and thirteen cases with asymmetric maxillary expansion. The amount of expansion was different in each case based on the amount of discrepancy which was planned before the treatment (Table 1).

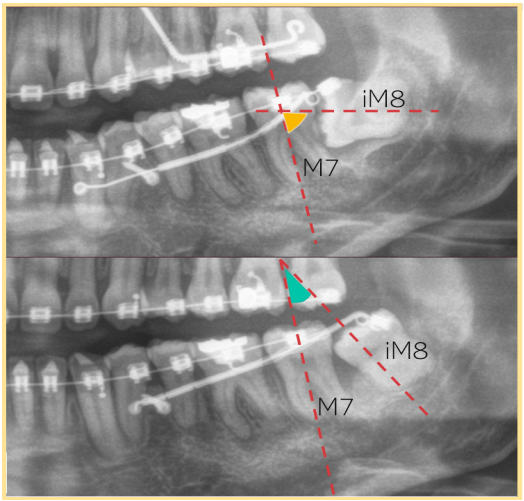

Fig 3. Panoramic radiograph; before and after treatment of uprighting 3rd molar

Assessment of the Tooth Movement: Demographic data, angulations of the iM8s before and after orthodontic uprighting, amount of iM8 angulation changes, iM8 uprighting durations, and rate of iM8 uprighting are shown in Table 4-1. Although The

Research Methodology

Subjects were recruited from patients at the Orthodontic Clinic at the Bangkokthonburi University in Chiang Mai, Thailand, whose iM8s were referred for removal as part of their orthodontic treatment plan, were recruited during the period of their orthodontic treatment plan. All 20 patients (8 males and 12 females), the mean age was 23.9 ± 4.3 years, had mesio-angulated and horizontal third molars with Class I or II impaction and depth B or C according to the Pell & Gregory classification (Pell GJ.,1933) and the Winter classification(Winter GB.,1926), respectively. The inclusion criteria were good general health, good oral hygiene, and healthy periodontium and no use of medications affecting tooth movement or contraindicated for surgery, no systemic disease, and completed data collection.

The miniscrew-supported molar uprighting spring was proposed by Suzuki and Suzuki (Suzuki & Suzuki, 2008). The appliance composed of a single interradicular miniscrew inserted with 3D surgical guide (length, 6 mm; diameter, 1.6 mm) (Dual top JB; Jeil Medical Corporation, Seoul, Korea) and the molar uprighting spring contained a closed coil spring and 150 gram-open nickel-titanium (NiTi) coil spring wrapping around a 0.017 x 0.025-inch SS rectangular wire, which was bent to form a hook and a helical loop at the mesial and the distal ends, respectively. This device, named the Smart Spring (Y&B Products, Chiangmai, Thailand), is shown in Figure 1.

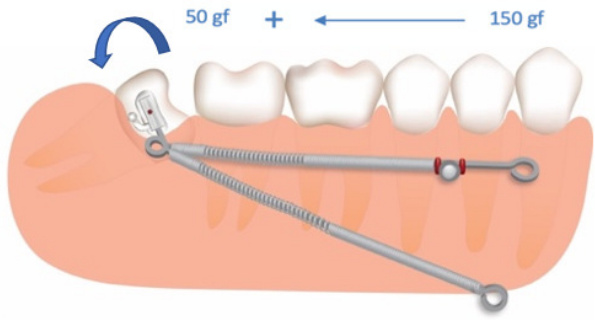

Fig 1. The Smart Spring with miniscrew appliances

Altered movement and angulation of 20 iM8s and adjacent second molars in the OE group were monitored and assessed using pre-and post-operative panoramic radiographs, and Smart's Ceph for Smart Spring v1.1 software(Y&B Products, Chiangmai, Thailand), to evaluate the rate of movement of the system.

However, the benefits and efficacy of this technique have not been examined in terms of rate of tooth movement or amount of molar uprighting.

Objectives and Hypothesis

The objective of this study was:

1. to examine the rate and amount of movement of iM8 uprighting with the Smart Spring anchored miniscrew appliances.

Review of Literatures

Orthodontic Extraction with miniscrew anchorage

The OE technique was introduced in 1996 by Checchi et al (Checchi et al., 1996), they published a case report of 21 female patients who had a third molar close to the mandibular canal, using a surgical orthodontic They concluded performing extractions with this procedure safer in reducing post-surgical complications. However, Checchi et al used dental anchorage despite it has never been reported scientifically about the amount of occlusal change using the OE technique with dental anchorage, revealing of clinical cases in previous studies showed undesirable dental anchorage movement.

Park et al (Park et al., 2010), introduced an OE technique of iM8 with a miniscrew implant as an indirect anchorage, in which a continuous nickel and titanium archwire was used in the leveling stage of treatment. However, this indirect anchorage needs a precise setting to connect miniscrew to dental anchorage teeth, otherwise, undesirable tooth movement is possible.

Nienkemper et al (Nienkemper et al., 2016) reported two cases, using Orthodontic uprighting mesially impacted lower third molar with a miniscrew implant. With this direct anchorage from the mini-implants, there is no risk of anchorage loss or undesired tooth movement.

However, the benefits and efficacy of this technique have not been examined in terms of rate of tooth movement or amount of molar uprighting.

Conceptual Framework

mandibular third molars (iM8s). However, the benefits and efficacy of this technique have not been examined in terms of rate of tooth movement or amount of molar uprighting.

The objectives of this study were to assess, using panoramic radiographs, the rate and amount of tooth movement during application of OE with miniscrew combined uprighting spring. In this prospective study, 20 horizontally and mesioangular iM8s, which required extraction and planned for OE, were uprighted using Smart Spring connected to a single miniscrew anchorage. Panoramic radiographs were recorded at the initial visit, monthly, and by the end of the iM8 uprighting. Changes in iM8 movement and angulation were monitored and assessed using panoramic radiographs to clarify the efficacy of the OE system. All iM8s in the OE group was removed by simple extraction. All patients in the OE group received simple extraction without any complication.

Keywords: Orthodontic extraction, uprighting, miniscrew, third molar, bracket

Introduction

Mandibular third molar removal is a common procedure in oral and maxillofacial surgery (Monaco et al., 2015). In orthodontics, where the majority of patients are in their early adulthood, patients are often referred for the surgical removal of their third molars, although third molars are not directly involved in orthodontic treatment.(Bui et al., 2003) (Larsen, 1992)

Although the surgical procedures are relatively safe, risks and complications are present. The most common complications are alveolar osteitis, infections, hemorrhage, damage to adjacent teeth, periodontal problems with adjacent teeth, bone fractures, facial swelling, and lingual or inferior alveolar nerve (IAN) injury. (Lang et al., 2017)

To minimize the related risks and complications, the use of orthodontic appliances to upright the impacted third molar from a difficult position before their simple removal, the so-called Orthodontic Extraction (OE). (Ecuyer & Debien, 1984) The OE technique, a specially designed orthodontic appliance is often necessary to provide anchorage which the use of miniscrew implants as absolute anchorage (Baumgaertel, 2014) to avoid undesirable dental movement in the anchorage units.