

การสร้างกระดูกขึ้นใหม่หลังการผ่าตัดเอาฟันกรามที่สามที่ขากรรไกรล่างที่ได้รับผลกระทบออก :  
การศึกษานำร่อง

## **Bone Regeneration Following Surgical Removal of Impacted Mandibular Third Molars : A Pilot Study**

ผู้วิจัย วาสนา กุลาตี  
สาขาวิชา ทันตกรรมจัดฟัน มหาวิทยาลัยกรุงเทพมหานครบุรี  
อาจารย์ที่ปรึกษา อ.ดร.เอตวาร์ตโด ยูโก้ ซูซูกิ และ รศ.ทพญ.ดร.บุญศิวา ซูซูกิ  
ภาควิชา ทันตแพทยศาสตร์ มหาวิทยาลัยกรุงเทพมหานครบุรี

### **บทคัดย่อ**

การผ่าตัดเอาฟันกรามที่สามที่ขากรรไกรล่าง (iM8) ออก อาจก่อให้เกิดความบกพร่องของปริทันต์ในส่วนปลายของฟันกรามที่สองที่ขากรรไกรล่าง เพื่อประเมินปริมาณและอัตราการคืนกลับของกระดูกบนพื้นผิวส่วนหลังของฟันกรามที่สองล่าง (iM7s) หลังจากการผ่าตัดเอา iM8 ออก และเพื่อประเมินแง่มุมของการเพิ่มของกระดูกตามความรุนแรงตำแหน่งของ iM8s

ผู้ป่วยที่เป็นผู้ใหญ่ 40 รายที่มี iM8 แบบฝังตัว ถูกจัดกลุ่มเป็นแบบอ่อน ปานกลาง และรุนแรงตามความรุนแรงตำแหน่งของ iM8s ถูกผ่าตัดออกด้วยเทคนิคทั่วไป เก็บข้อมูลจากการถ่ายภาพรังสีพาโนรามิกที่ได้รับในช่วงเริ่มต้น (T0) และหลังจากผ่าตัดฟันคุด 6 เดือน (T1) ปริมาณของกระดูกที่เพิ่มขึ้นที่ตำแหน่งด้านหลังของ iM7 จะถูกวัดและวิเคราะห์ทางสถิติที่สำคัญ

ฟันทั้งหมดถูกถอนออกได้สำเร็จโดยไม่มีอาการแทรกซ้อน การสร้างกระดูกใหม่โดยเฉลี่ยที่ส่วนหลังของ iM7 คือ  $1.6 \pm 0.8$  มม. ไม่พบความแตกต่างอย่างมีนัยสำคัญในปริมาณของการสร้างกระดูกใหม่ระหว่างอ่อน ( $1.7 \pm 0.9$  มม.) ปานกลาง ( $1.6 \pm 0.8$  มม.) และรุนแรง ( $1.6 \pm 1.0$  มม.) อย่างไรก็ตาม พบความแตกต่างอย่างมีนัยสำคัญในเปอร์เซ็นต์การเปลี่ยนแปลงของการเพิ่มของกระดูกจากค่าพื้นฐานระหว่างระดับอ่อน ( $280.7 \pm 205.6\%$ ) ปานกลาง ( $79.0 \pm 62.7\%$ ) และรุนแรง ( $36.6 \pm 17.1\%$ ) ( $p < 0.01$ )

การผ่าตัดเอา iM8 ออกส่งผลให้ปริมาณการสร้างกระดูกขึ้นใหม่ลดลงโดยค้ำิ่งตามความรุนแรงของตำแหน่งของ iM8

**คำสำคัญ :** การผ่าตัด, การเพิ่มกระดูก, ฟันกรามคุดซี่ที่สาม

## Abstract

Surgical removal of impacted mandibular third molars (iM8s) generates periodontal defects on the distal aspect of the mandibular second molars (iM7s).

To assess the amount and rate of bone regeneration on the distal surface of the iM7s following the surgical removal of the iM8s, and to evaluate the aspects of bone gain according to the severity of impaction.

40 adult patients with embedded iM8s were enrolled. The iM8s were grouped into mild, moderate, and severe according to the severity of impaction. The iM8s were surgically removed with conventional techniques. Panoramic images obtained at the beginning (T0) and after 6 months follow-up (T1) were acquired and the total amount of bone regeneration distal to the iM7s was measured and analyzed statistically.

All teeth were removed successfully without complications. The average bone regeneration on the distal of the iM7s was  $1.6 \pm 0.8$  mm. No significant difference in the amounts of bone regeneration between mild ( $1.7 \pm 0.9$  mm), moderate ( $1.6 \pm 0.8$  mm), and severe ( $1.6 \pm 1.0$  mm) was observed. However, a significant difference in the percentage change in the bone gain from the baseline between the mild ( $280.7 \pm 205.6\%$ ), moderate ( $79.0 \pm 62.7\%$ ), and severe ( $36.6 \pm 17.1\%$ ) was observed. ( $P < 0.01$ )

The surgical removal of iM8s resulted in a reduced amount of spontaneous bone regeneration regardless of the severity of iM8s impaction

**Key Word (s): Surgical Removal, Bone gain, Impacted Mandibular Third Molar**

## บทนำ

Surgical extraction of impacted mesioangular mandibular third molar (iM8s) often leads to undesirable periodontal defects distal of the adjacent mandibular second molar (iM7s) (1).

Therefore, several surgical approaches such as coronectomy (2) and the use of guides bone regeneration technique (3) in the extracted site have been suggested to minimize such complications. However, these methods present limitations. The coronectomy might result in inflammation and pain in the remaining roots of the iM8s and requires a second surgery for the complete removal of the residual roots (2) and the use of alloplastic fully resorbable bone grafting material in the extracted sites results in additional costs and risks (3).

The use of orthodontic extraction (OE) has been proposed to gradually move high-risk iM8s from a difficult position, thus allowing their simple and safe removal (4, 5). Moreover, this technique is advantageous for improving the osteoperiodontal healing distal to the iM7s with bone gain (6, 7).

The OE technique requires excellent anchorage control to avoid unwanted dental movement, therefore, tooth-supported appliances are not often recommended (8). Therefore, the OE techniques with miniscrew-supported spring appliances, which provide excellent anchorage control, are commonly used with satisfactory results (9-11).

However, the effects of the surgical removal of iM8s on the spontaneous bone regeneration distal to the iM7s have not been fully investigated.

### วัตถุประสงค์ของการวิจัย

The purpose of the present study was to assess the amount and rate of bone regeneration on the distal surface of the iM7s following the surgical removal of the iM8s and to evaluate the aspects of bone gain according to the severity of impaction.

### กรอบแนวความคิดในการทำการวิจัย

Be able to apply knowledge gained from research and predict an outcome which could be beneficial to inform the patient before treatment.

### วิธีการวิจัย

In this prospective cohort study, forty patients, at the Graduate Clinic, Department of Orthodontics, Faculty of Dentistry, Bangkokthonburi University, consisting of 22 females and 18 males, who were referred for the removal of the iM8s as part of Orthodontic treatment plan, were recruited from January to September 2019. To be included in the study sample, the patients had to be healthy, and be free of pericoronitis and infection at the surgery. The patients were excluded as study subjects if they had any missing data or recall visits or they reported the use of nontrivial drugs during the observation period.

The study was conducted in agreement with the Helsinki Declaration and ethical approval was obtained from the Bangkokthonburi University Research Ethics Committee (No. 11/2561). Detailed surgical procedures and potential risks were explained to each patient, who provided written and dated informed consent before the start of the study.

In the present study, all patients had their iM8s removed surgically with conventional techniques by a single experienced surgeon.

### **Radiograph images**

Assessment of bone gain distal to the iM7s was performed using the images of Panoramic images taken at the beginning (T0) 6 months follow-up (T1). Angular measurements were performed with custom-made software (Smart Ceph MIB v1.1, Y&B Products) while the linear distances were measured by using the ImageJ software version 1.51r (National Institute of Health, Bethesda, MD, USA). Assessment of bone gain was performed using the highest point of alveolar crest bone at distal to the iM7 to CEJ line (h). (Fig. 1) Differences between the T0 and T1 measurements were performed to define the amount of bone gain for both groups (h0-h1). Because of its unique nature, panoramic radiography was not able to avoid positioning errors and distortions(12). Therefore, the difference in distortion rate of the images was revised following the guidelines described by Kim et al.(13). Adjustment of the image distortion from T0 and T1 was performed using a correction index. The CEJ line (L) of iM7 from L1 was used as the reference, and the ratios of L0 to L1 were calculated (L1/L0). This ratio, referred to as the distortion factor index (DFI), was applied to h0 (DFI x h0=h0') to correct distortion variations between images(13). The difference of bone gain distal to the iM7s was measured (h0'-h1) and analyzed statistically.

### **Statistical Analysis**

Measurements were repeated after two weeks, and a paired t-test revealed no difference between the two assessments ( $P>0.05$ ). Therefore, the second set of measurements was used. After confirming the normality of the data distribution using the Shapiro-Wilk test, a Student's paired t-test was performed to compare the values between T0 and T1. Linear and angular variables were measured and statistically analyzed ( $P<0.05$ )

### ผล/สรุปผลการวิจัย

All teeth were removed successfully without complications. The average bone regeneration on the distal of the iM7s was  $1.6 \pm 0.8$  mm. No significant difference in the amounts of bone regeneration between the mild ( $1.7 \pm 0.9$  mm), moderate ( $1.6 \pm 0.8$  mm), and severe ( $1.6 \pm 1.0$  mm) was observed. However, a significant difference in the percentage change in the bone gain from the baseline between the mild ( $280.7 \pm 205.6\%$ ), moderate ( $79.0 \pm 62.7\%$ ), and severe ( $36.6 \pm 17.1\%$ ) was observed. ( $P < 0.01$ ) (Fig 2.)

Within the limitations of the present study, we conclude that the surgical removal of iM8s resulted in a reduced amount of spontaneous bone regeneration regardless of the severity of iM8s impaction.

### อภิปรายผล

Several studies have investigated distal periodontal healing as well as potential injuries to the iM7s after the removal of iM8s but few of them mention the iM8s position. (13) According to Kim et al., the difficulty of the surgical removal of the iM8s depends on its shape, location, position, and angulation. (13) Moreover, Susarla et al. concluded that the difficulty in the surgical removal of the iM8s is related to their depth and angulation. (14)

In the present study, the least bone regeneration was found at the distal of iM7s in the severe group. The results supported the previous studies, considering surgical removal of iM8s in severe positions was the most difficult procedure among all groups.

A limitation of the present study was the use of panoramic radiography for the assessment of bone gain (12). However, the panoramic film is widely used in routine orthodontics it has the advantage of showing surrounding anatomical structures as well as the teeth. However, the panoramic image has an average magnification of 15% to 25% depending on the patient's position (12). Therefore, the difference in distortion rate of the images was revised following the guidelines described by Kim et al. (13).

### ข้อเสนอแนะ

Further studies using the data from the cone-beam computed tomography are necessary for both avoiding distortions and obtaining more accurate results.

### กิตติกรรมประกาศ

The authors thank Dr. Somyot Limpanaputtajak, Faculty of Dentistry, Bangkokthonburi University, Thailand, for his role as an oral surgeon and the financial support from the faculty of Dentistry, Bangkokthonburi University, Thailand.

### เอกสารอ้างอิง

1. Tabrizi R, Arabion H, Gholami M. How will mandibular third molar surgery affect mandibular second molar periodontal parameters? Dent Res J (Isfahan). 2013;10(4):523-6.
2. Pogrel MA, Lee JS, Muff DF. Coronectomy: A technique to protect the inferior alveolar nerve. J Oral Maxillofac Surg. 2004;62(12):1447-52.

3. Iocca O FA, Pardiñas Lopez S, Talib HS. Alveolar Ridge Preservation after tooth extraction: a Bayesian Network meta-analysis of grafting materials efficacy on prevention of bone height and width reduction. *J. Clin. Periodontol.* 2017;44(1):104-14.
4. Checchi L, Bonetti GA, Pelliccioni GA. Removing high risk impacted mandibular third molars: a surgical-orthodontic approach. *J Am Dent Assoc* 1996;127(8):1214-7.
5. Alessandri Bonetti G, Incerti Parenti S, Checchi L. Orthodontic extraction of mandibular third molar to avoid nerve injury and promote periodontal healing. *J. Clin. Periodontol.* 2008;35:719-23.
6. Guida L, Cuccurullo G, Lanza A, Tedesco M, Guida A, Annunziata M. Orthodontic-Aided Extraction of Impacted Third Molar to Improve the Periodontal Status of the Neighboring Tooth. *J Craniofac Surg.* 2011;22:1922-4.
7. Montevicchi M, Incerti Parenti S, Checchi V, Palumbo B, Checchi L, Alessandri Bonetti G. Periodontal healing after 'orthodontic extraction' of mandibular third molars: A retrospective cohort study. *Int J Oral Maxillofac Surg.* 2014;43(9):1137-41.
8. Cho H, Lynham AJ, Hsu E. Postoperative interventions to reduce inflammatory complications after third molar surgery: review of the current evidence. *Aust Dent J.* 2017;62(4):412-9.
9. Park W, Park J-S, Kim Y-M, Yu H-S, Kim K-D. Orthodontic extrusion of the lower third molar with an orthodontic mini implant. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod.* 2010;110(4):e1-e6.
10. Wang Y, He D, Yang C, Wang B, Qian W. An easy way to apply orthodontic extraction for impacted lower third molar compressing to the inferior alveolar nerve. *J Craniomaxillofac Surg.* 2012;40(3):234-7.
11. Wang Z, Liu Z, Shi Y, Fang D, Li S, Zhang D. A Novel Orthodontic Extraction Method for Removal of Impacted Mandibular Third Molars in Close Proximity to Inferior Alveolar Nerve. *J Oral Maxillofac Surg.* 2019;77(8):1575.e1-.e6.
12. Yeo D, Freer T, Brockhurst P. Distortions in panoramic radiographs. *Aust Orthod J.* 2002;18:92-8.
13. Kim E, Eo MY, Nguyen TTH, Yang HJ, Myoung H, Kim SM. Spontaneous bone regeneration after surgical extraction of a horizontally impacted mandibular third molar: a retrospective panoramic radiograph analysis. *Maxillofac Plast Reconstr Surg.* 2019;41(1):4-.
14. Susarla SM, Dodson TB (2004) Risk factors for third molar extraction difficulty. *J Oral Maxillofac Surg.* 62:1363–1371.