SURGICAL OUTCOMES OF PARANT II IMPACTED MANDIBULAR THIRD MOLAR REMOVAL USING A VERTICAL CORONECTOMY TECHNIQUE WITH A 45-DEGREE HANDPIECE

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ABSTRACT

Objectives: To evaluate the surgical outcomes of mandibular third molar (MTM) removal with Parant II impaction using the vertical tooth sectioning technique assisted by a 45° angled handpiece.

Methods: A prospective interventional clinical study was conducted on 95 patients treated at Bach Mai Hospital and Hai Phong University of Medicine and Pharmacy Hospital, employing a pre- and post-intervention design without a control group.

Results: The mean surgical duration was 25.3 ± 7.1 minutes; patients over 25 years of age required significantly longer procedures (28.0 minutes) compared to those aged 16–25 years (23.0 minutes) (p = 0.01). Pain, swelling, and trismus peaked at 48 hours postoperatively and markedly subsided after 7 days. The complication rate was low, including infection (5.3%), postoperative bleeding (3.2%), and transient neurosensory disturbance (1.1%), despite 40% of the teeth being in proximity to the inferior alveolar canal. Overall outcomes were classified as Good in 67%, Fair in 24%, and Poor in 9% of cases. Predictors of poorer outcomes included age > 25 years (aOR = 1.9), history of pericoronitis (aOR = 2.4), impaction depth C (aOR = 3.8), and prolonged surgical duration (aOR = 1.25).

Conclusion: The vertical tooth sectioning technique using a 45° angled handpiece is a safe and effective approach for Parant II mandibular third molar extractions, providing good postoperative recovery and minimizing complications, particularly inferior alveolar nerve injury.

Keywords: Mandibular third molar, Parant II, Vertical coronectomy, 45-degree handpiece, Surgical outcome.

1. INTRODUCTION

Impacted mandibular third molars (MTMs) are one of the most common pathologies in oral surgery, with a very high rate of impaction. Some domestic studies indicate that mesial impaction accounts for up to 76.6% of cases [1, 2, 3]. The presence of impacted MTMs causes many serious complications affecting the patient's quality of life, including recurrent pericoronitis, distal caries of the adjacent second molar (often leading to irreversible pulpitis), and the formation of dentigerous cysts capable of causing jawbone resorption.

The Parant classification is a classic system, useful in clinical practice as it predicts difficulty and guides surgical technique. This study focuses on the Parant II group, defined as surgical cases requiring both techniques: bone removal (partial) and tooth sectioning. The classic technique for managing these teeth is typically horizontal crown sectioning. However, this maneuver in the limited space of the retromolar area (behind the second molar) can be very difficult, easily leading to excessive bone removal, increased risk of soft tissue trauma, damage to adjacent anatomical structures, and prolonged surgical time. To address these challenges, technical innovations have been proposed, including a surgical method combining two elements: Instead of horizontal cervical sectioning, this technique uses a bur to make a vertical cut along the tooth axis (usually mesial-distal or buccal-lingual), splitting the crown into two parts. This allows the surgeon to remove

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each part of the tooth easily, reducing leverage forces and minimizing the need for wide bone removal to create an extraction path; Use of a 45-degree angled handpiece: this is a key supporting tool. The 45-degree angle design of the handpiece (e.g., Morita) allows the surgeon optimal access to the third molar region from the buccal or distal aspect, which is obstructed for a conventional straight handpiece by the cheek and the second molar. This angle enhances visibility, allowing for precise and safe cuts, especially in cases where the roots are near critical anatomical structures like the inferior alveolar nerve canal.

Although this technique has been applied in clinical practice, there is still a lack of systematic interventional studies in Vietnam to quantitatively evaluate the efficacy, safety, and postoperative outcomes (pain, swelling, trismus) of combining the vertical tooth sectioning method with a 45-degree handpiece. Therefore, we conducted this study to evaluate the surgical outcomes of Parant II impacted MTM removal using the vertical tooth sectioning technique with a 45-degree handpiece.

2. SUBJECTS AND METHODS

2.1. Study Design: A prospective interventional clinical study with a pre- and post-intervention, non-controlled design.

2.2. Subjects and Sample Size

The study was conducted on 95 patients (corresponding to 95 MTMs) presenting for surgical treatment at the Department of Odonto-Stomatology, Bach Mai Hospital, and the Department of Odonto-Stomatology, Hai Phong University of Medicine and Pharmacy Hospital. Sample collection period was from January 2025 to September 2025.

Applying the sample size formula for pre-post studies:

$$n \geq \frac{2C(1 - r)}{(ES)^2}$$

Where:

+ C is a constant = 7.85 ;

+ r: is the correlation coefficient (r = 0.8);

+ ES: is the effect size. ES = d/s. Where d is the expected change in mean mouth opening before and after surgery; s is the standard deviation of mouth opening in a study. According to the study by Lam Nhut Tan et al. (2017-2018) [4], s = 0.6; the expected d is 0.12; ES = 0.12/0.6 = 0.2. Substituting into the formula, the minimum sample size n = 79. In reality, we collected 95 study subjects..

+ Inclusion criteria: Patients diagnosed with impacted MTMs classified as Parant II (indicated for bone removal and tooth sectioning); Good general health status, no progressing chronic diseases; Patients voluntarily participating in the study.

- Exclusion criteria: MTMs not classified as Parant II; Patients with uncontrolled systemic diseases (such as diabetes, coagulation disorders); Patients who are pregnant or undergoing radiotherapy in the maxillofacial region.

2.3. Variables and Study Indicators

- Radiographic characteristics: Pell & Gregory classification (Impaction depth A, B, C; Ramus space I, II, III), orientation (vertical, mesioangular), relationship to the inferior alveolar nerve (IAN) canal (contact, no contact).

- Intraoperative indicators: Surgical duration (in minutes, from incision to the last suture) and intraoperative complications (root fracture, alveolar bone fracture, uncontrolled bleeding).

- Postoperative indicators: Assessed at 6 hours, 48 hours, and 7 days post-surgery.

+ Pain level: Assessed using a 5-point VAS scale (0: no pain, 1: transient pain, 2: mild pain, 3: moderate pain, 4: severe pain, 5: very severe pain).

+ Swelling level: Measured with a soft tape measure at 2 indices (S1S2: earlobe - corner of the mouth; S3S4: angle of the mandible - outer canthus of the eye). The swelling level was calculated as the mean difference compared to pre-surgery.

+ Trismus (limited mouth opening): Measured the distance between the incisal edges of the central incisors (mm) and calculated the difference (reduction) compared to pre-surgery.

2.4. Outcome Assessment and Analysis

The overall surgical outcome was assessed after 7 days at 3 levels: Good, Fair, Poor. Data were collected on research forms and processed using SPSS 20.0 software. The study was approved by the Institutional Review Board (IRB) in biomedical research of Hai Phong University of Medicine and Pharmacy (No. 12/CNCT-IRB dated May 5, 2025) and the IRB of Bach Mai Hospital (No. 52/BM-HĐĐĐ dated July 15, 2025). All participating patients were clearly explained the purpose and procedures and signed a voluntary consent form.

3. RESULTS

3.1. Characteristics of Study Subjects

Table 1. Clinical and historical characteristics of study subjects (n=95)

Indicator	n	%
Gender		
Male	55	57.9
Female	40	42.1
Age Group		
16-25	53	55.8
>25	42	44.2

Indicator	n	%
Reason for Visit		
Prophylactic removal	37	38.9
Swelling/Pain (Pericoronitis)	25	26.3
Food impaction	22	23.2
Other (orthodontics...)	11	11.6
History of Pericoronitis		
No	46	48.4
Yes	49	51.6

Pericoronitis rate in >25 group (66.7%) was higher than 16-25 group (39.6%). p=0.009

A total of 95 patients (95 teeth) were included in the study. The mean age was 27.6 ± 9.9 years, with the 16-25 age group being the majority (55.8%). Males accounted for 57.9%, slightly higher than females (42.1%). The most common reason for presentation was prophylactic removal (38.9%), followed by local swelling and pain (pericoronitis) (26.3%) and food impaction (23.2%). Notably, 51.6% of patients had a history of pericoronitis before surgery. When analyzed by age group, the rate of pericoronitis in the >25 age group (66.7%) was statistically significantly higher (p=0.009) than in the 16-25 age group (39.6%).

3.2. Radiographic Characteristics (MTM Classification)

Table 2. Radiographic characteristics of Parant II MTMs (n=95)

Indicator	n	%
Impaction Status		
Fully impacted	50	52.6
Impacted with pericoronitis	45	47.7
Depth (Pell & Gregory)		
A (shallow)	49	51.6
B (medium)	37	38.9
C (deep)	9	9.5
Ramus Space (Pell & Gregory)		
I (sufficient)	21	22.1
II (partially deficient)	46	48.4
III (completely deficient)	28	29.5
Orientation		
Mesioangular	69	72.6
Vertical	26	27.4
IAN Canal Relationship		
No contact	57	60.0
Contact	38	40.0

Panoramic film analysis showed 52.6% of teeth were fully impacted and 47.7% were impacted with pericoronitis. According to the Pell & Gregory classification, regarding depth, the majority of teeth were at level A (shallow - 51.6%) and B (medium - 38.9%). Only 9.5% of teeth were at depth C (deep). Regarding ramus space, Type II (space smaller than the crown) had the highest rate (48.4%). The most common orientation was mesioangular (72.6%). 40.0% of teeth (38/95 cases) had radiographic images of roots in contact with the inferior alveolar nerve canal on the panoramic film.

3.3. Intraoperative Outcomes

Table 3. Surgical duration and intraoperative complications

Indicator	Result
Surgical Duration (minutes)	(Mean ± SD)
Overall (n=95)	25.3 ± 7.1
Age group 16-25 (n=53)	23.0 ± 6.0
Age group >25 (n=42)	28.0 ± 8.0
p (comparison of 2 age groups)	0.01
Intraoperative Complications (n=95)	n (%)
No complications	88 (92.6)
3rd Molar root fracture	3 (3.2)
Excessive bleeding	2 (2.1)
Alveolar bone fracture	1 (1.1)
Root fracture + Bone fracture	1 (1.1)

The mean surgical duration for all 95 cases was 25.3 ± 7.1 minutes. Analysis by age group showed a statistically significant difference (p=0.01): patients in the >25 age group had a longer mean surgical time (28.0 ± 8.0 minutes) compared to the 16-25 age group (23.0 ± 6.0 minutes). The rate of intraoperative complications was low (total 7.4%). The main complications were root fracture (3.2%), excessive intraoperative bleeding (2.1%), and alveolar bone fracture (1.1%).

3.4. Postoperative Course

Table 4. Postoperative indicators over time (Mean ± SD)

Postoperative Indicator	6 hours	48 hours	7 days
Pain Level (VAS)	3.5 ± 1.5	2.0 ± 1.0$	0.5 ± 0.5
Swelling Level (mm)	1.0 ± 1.0	5.0 ± 2.0$	1.0 ± 1.0
Trismus (mm)	4 ± 2	10 ± 4$	2 ± 2

The indicators of pain, swelling, and trismus all showed a clear physiological progression: gradually increasing from 6 hours post-surgery, peaking at 48 hours, then decreasing rapidly and nearly returning to normal after 7 days.

Pain (VAS): At 3.5 ± 1.5 (moderate pain) after 6 hours (when anesthesia wore off), decreased to 2.0 ± 1.0 (mild pain) after 48 hours, and was only 0.5 ± 0.5 (almost no pain) after 7 days.

- Swelling (mm): Increased from 1.0 ± 1.0 mm (6h) to a peak of 5.0 ± 2.0 mm (48h), and reduced sharply to 1.0 ± 1.0 mm (7 days).

- Trismus (mm): Mouth opening decreased by 4 ± 2 mm (6h), maximally decreased by 10 ± 4 mm (48h), and only decreased by 2 ± 2 mm (7 days).

3.5. Early Complications and Overall Outcome

Table 5. Early complications and overall outcome after 7 days (n=95)

Indicator	n	%
Early Postoperative Complications		
Socket infection	5	5.3
Postoperative bleeding	3	3.2
Neurosensory disturbance (numbness)	1	1.1
Overall Outcome (after 7 days)		
Good	64	67.0
Fair	23	24.0
Poor	8	9.0

The rate of early postoperative complications (within 7 days) was noted to be low. The most common was socket or suture site infection (5.3%), followed by postoperative bleeding (3.2%). The most notable result regarding safety was only 1 recorded case (1.1%) showing signs of neurosensory disturbance (lip/chin numbness), with no cases of lingual nerve injury. Assessment of the overall outcome after 7 days according to the established criteria: 67% of patients achieved a Good outcome, 24% achieved a Fair outcome, and 9% were assessed as Poor.

3.6. Analysis of Factors Related to Surgical Outcome

Table 6. Multivariate logistic regression analysis of factors related to surgical outcome

Factor	aOR (Adjusted Odds Ratio)	95% CI	p
Age > 25 (vs. ≤ 25)	1.9	1.11 – 3.5	0.020
History of Pericoronitis (vs. No)	2.4	1.17 – 4.92	0.016
Depth (Pell & Gregory)			
B (vs. A)	1.68	0.88 – 3.21	0.110
C (vs. A)	3.82	1.33 - 10.96	0.013
Surgical Duration (per 5 min)	1.25	1.08 – 1.45	0.003

The multivariate logistic regression analysis identified 4 independent predictors that increase the risk of a poor surgical outcome: Depth C: This was the strongest risk factor (aOR = 3.82; p = 0.013); History of pericoronitis: (aOR = 2.4; p = 0.016); Age > 25: (aOR = 1.9; p = 0.020); Surgical duration: Every additional 5 minutes of surgery increased the risk of a poor outcome by 1.25 times (aOR = 1.25; p = 0.003).

Other factors such as gender, ramus space (Type I, II, III), and tooth orientation were not statistically significant in the final regression model.

4. DISCUSSION

This study evaluates a specific surgical method (vertical tooth sectioning combined with a 45-degree handpiece) for a specific patient group (Parant II MTMs). The results show this is a safe and effective technique, with well-controlled postoperative outcomes. The mean surgical time of 25.3 minutes for a Parant II case (which requires bone removal and tooth sectioning) is a very effective and competitive result. This result is consistent with the study by Lam Nhut Tan (2019), which also applied the vertical tooth sectioning technique, reporting a mean surgical time of about 20-30 minutes [4]. This indicates that the vertical sectioning technique, when supported by appropriate tools (45-degree handpiece), optimizes the procedures.

A key point is the relationship between age and surgical duration. Our results show the >25 age group took longer. This can be explained by combining several results: the >25 age group not only has denser bone (physiologically), but also a higher rate of fully impacted teeth and a higher rate of chronic pericoronitis (66.7%). The combination of denser bone, deeper teeth, and fibrous scar tissue from chronic inflammation makes the surgery more complex and prolonged. The postoperative course (pain, swelling, trismus) in this study followed the correct physiological healing model, with the inflammatory peak reached after 48 hours and rapid remission after 7 days. This shows the surgical technique, although invasive, did not cause excessive or prolonged trauma. This result is consistent with domestic and international studies on postoperative course after wisdom tooth extraction [5, 6, 7].

The most outstanding and valuable point of this study is proving the technique's safety, especially neurological safety. The radiographic results showed a very high rate (40.0% or 38/95 teeth) with images "contacting" the inferior alveolar nerve canal on panoramic films. This is a high-risk group for nerve injury (lip/chin numbness). However, the clinical results showed only 1 single case (1.1%) with temporary neurosensory disturbance, and no cases of permanent injury. This rate is lower than many reports in the literature [8, 9, 10]. This success in nerve protection can be directly attributed to the use of the 45-degree handpiece. This angle allows the surgeon to control the vertical cutting path precisely, parallel to the tooth axis and the nerve canal, avoiding drilling

too deep or cutting horizontally into the root apex area near the nerve canal. Simultaneously, the vertical tooth sectioning technique helps to split the tooth, significantly reducing the leverage force needed to remove it, thereby reducing pressure on the underlying nerve canal.

Other complications such as infection (5.3%) and root fracture (3.2%) were at low levels, within acceptable limits for Parant II surgery and comparable to other studies [11, 12].

The logistic regression model provides strong evidence for factors predicting surgical outcomes. The results show the success of the surgery depends not only on the technique but is also heavily influenced by the patient's initial condition and the tooth's anatomical position. Depth C (aOR=3.82): This is the biggest risk factor. This is clinically logical, as the deeper the tooth (located completely below the cervical line of the 2nd molar), the more bone the surgeon must remove, the narrower and deeper the surgical field, leading to increased trauma and prolonged surgical time. History of pericoronitis (aOR=2.4): This factor emphasizes that extracting a tooth in tissue that has been chronically inflamed (even if stabilized) still has consequences. Fibrous scar tissue and residual bacteria in the gingival pocket increase the risk of postoperative infection and slow the healing process. Age > 25 (aOR=1.9): This result, combined with data on surgical time and impaction status, once again confirms the clinical recommendation to extract MTMs early (ideally before age 25) when the bone is softer, healing capacity is better, and the tooth has not been pushed into a deeper, impacted position. Surgical duration (aOR=1.25): This factor is both a cause and an effect. A difficult tooth (deep, ankylosed, fibrotic) makes the surgery longer; and conversely, the longer the surgery (prolonged flap exposure, extensive irrigation, cumulative trauma), the stronger the inflammatory response (swelling, pain) and the higher the risk of infection.

5. CONCLUSION

The vertical tooth sectioning method using a 45-degree angled handpiece is an effective and safe technique. The mean surgical duration is short (25.3 ± 7.1 minutes). Postoperative outcomes (pain, swelling, trismus) are well-controlled, follow a physiological response, and recover quickly after 7 days. The rate of Good and Fair outcomes reached 91%. The rates of intraoperative and postoperative complications are low. Notably, the rate of neurosensory disturbance is only 1.1%, demonstrating this technique provides good protection for the inferior alveolar nerve structure, even in a high-risk patient group (40% in contact with the nerve canal). There are 4 independent predictors for a poorer surgical outcome, including: tooth at depth C (aOR=3.82), a history of pericoronitis (aOR=2.4), patients over 25 years old (aOR=1.9), and prolonged surgical duration (aOR=1.25 for every 5 minutes).

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