

**Comparative evaluation of post-operative outcomes in operculectomy procedures using conventional, electrocautery and diode laser techniques**

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**Abstract**

**Aims:** Pericoronitis causes considerable discomfort, encompassing pain and edema, so requiring proficient surgical intervention. Operculectomy is a surgical procedure used to excise the operculum, a soft tissue flap that envelops the crown of a partially erupted tooth, sometimes associated with pericoronitis This research evaluates the postoperative results of operculectomy employing three distinct methods: standard scalpel, electrocautery, and diode laser.

**Materials and Method:** The study assesses postoperative pain via the Visual Analogue Scale (VAS) and measures wound healing efficacy using the Early Wound Healing Index (EWHI) after a duration of seven

days. Twenty-four patients were evenly distributed across the three method groups and monitored for these criteria. Statistical analysis indicated that both electrocautery and diode laser techniques greatly alleviated postoperative pain in comparison to the scalpel method, with the diode laser resulting in the least discomfort.

**Results:** Likewise, wound healing results were more favorable in both the electrocautery and diode laser cohorts compared to the scalpel cohort. The diode laser group had marginally superior wound healing ratings compared to the electrocautery group; nevertheless, the difference lacked statistical significance.

**Conclusion:** The results demonstrate that diode laser and electrocautery methods surpass the traditional scalpel in enhancing postoperative outcomes in operculectomy. Due to its somewhat superior performance, the diode laser may be regarded as a more favorable choice for operculectomy procedures.

**Keywords:** Operculectomy, Pericoronitis, Diode Laser, Electrocautery, Postoperative Pain, Wound Healing.

### **Introduction**

Pericoronitis is a common ailment observed in dental treatment, especially with the mandibular third molars. It is marked by inflammation and infection of the soft tissues that partially envelop the crown of an emerging tooth, referred to as the operculum. This inflammation may be intensified by mechanical injury, food obstruction, or microbial buildup beneath the tissue flap. Symptoms frequently encompass discomfort, edema, restricted oral aperture, and in extreme instances, systemic manifestations such as pyrexia and lymphadenopathy (Nitzan, 2017). The illness not only induces discomfort but may also jeopardize oral function and overall health if neglected.

Prompt therapy of pericoronitis is crucial to mitigate symptoms and avert complications such as abscess formation or the dissemination of infection to surrounding areas. Operculectomy, the surgical excision of the operculum, is the ultimate intervention for recurring or chronic pericoronitis. Traditionally, the scalpel technique was the preferred procedure for operculectomy, esteemed for its straightforwardness and economic viability. Nevertheless, research indicates that this technique frequently results in considerable postoperative pain, increased blood loss, and prolonged recovery due to the damage caused to adjacent tissues (Sood et al., 2014; Cheung et al., 2010).

Electrocautery has surfaced as an option, providing the benefits of decreased intraoperative hemorrhage and enhanced hemostasis. The method entails utilizing high-frequency electric currents to remove tissue while concurrently coagulating blood arteries. Clinical studies demonstrate that electrocautery is linked to reduced postoperative discomfort and expedited recovery compared to the scalpel approach. This results from diminished mechanical trauma and thermal coagulation of tissues, which lower inflammatory responses and facilitate expedited wound closure (Goharkhay et al., 1999; Arashiro et al., 2000).

In recent decades, diode lasers have been prominent as a minimally invasive instrument for soft tissue procedures, such as operculectomy. Diode lasers function at wavelengths ranging from 800 to 980 nm, facilitating accurate cutting while minimizing heat injury to surrounding tissues. Research indicates that laser-assisted operculectomy yields less postoperative discomfort and improved wound healing relative to conventional techniques. The laser induces a protein coagulum on the wound surface, functioning as a biological dressing that occludes sensory nerve ends and diminishes inflammation (Pick et al., 1995; Parker, 2007). Moreover, lasers provide antibacterial properties and diminish the likelihood of postoperative infections, hence augmenting their therapeutic effectiveness (Genovese & Olivi, 2008).



Figure 1

This study aims to examine the postoperative outcomes of operculectomy conducted using traditional knife, electrocautery, and diode laser procedures. It specifically assesses the effectiveness of these approaches regarding postoperative pain and wound healing efficiency throughout a seven-day duration.

### Research Question

Is there a notable disparity in postoperative outcomes, particularly in pain alleviation and wound healing, among operculectomy procedures executed with traditional scalpel, electrocautery, and diode laser methods?

### Objectives

1. To evaluate postoperative pain levels using the Visual Analogue Scale (VAS).
2. To assess wound healing using the Early Wound Healing Index (EWHI).
3. To determine the comparative efficacy of the three techniques in reducing patient discomfort and promoting recovery.

### Methodology

#### Study Design and Population

This study was structured as a randomized, controlled clinical trial aimed at comparing postoperative outcomes of operculectomy utilizing three surgical techniques: traditional scalpel, electrocautery, and diode laser. Twenty-four patients, aged 17 to 45 years, diagnosed with pericoronitis necessitating operculectomy were included. The conditions for participation were as follows:

1. Patients requiring operculectomy for impacted mandibular third molars.
2. No systemic conditions affecting wound healing.
3. No history of medication that could alter pain perception or healing (e.g., steroids, anticoagulants).
4. Informed consent provided by participants.

Patients were randomly allocated into three groups using a lottery method:

- **Group I (Scalpel):** Operculectomy performed using a conventional scalpel (n=8).
- **Group II (Electrocautery):** Operculectomy using electrocautery (n=8).
- **Group III (Diode Laser):** Operculectomy with a diode laser operating at 810 nm (n=8).

### Procedure

All surgical procedures were performed under local anesthetic. The operculum was removed in each group with the designated procedure. Standard surgical scalpels were employed to excise the tissue in Group I. In Group II, electrocautery was executed using a monopolar electrosurgical equipment configured to cutting mode. Group III employed a diode laser in continuous wave mode for accurate excision with little thermal injury. All patients were provided with postoperative oral hygiene instructions and administered conventional analgesics.



Fig. 2: Clinical Armamentarium

### Postoperative Monitoring

Postoperative outcomes were assessed on the seventh day. Two primary parameters were evaluated:

1. **Postoperative Pain:** Measured using the Visual Analogue Scale (VAS).
2. **Wound Healing:** Assessed using the Early Wound Healing Index (EWHI) by Landry et al. (1988), which rates healing from very poor (1) to excellent (5) based on tissue color, bleeding, and granulation.

## Statistical Analysis

The gathered data were analyzed utilizing SPSS (version 26.0). Group differences were assessed using ANOVA, followed by post hoc pairwise comparisons utilizing Tukey's test for statistical significance. A p-value of less than 0.05 was deemed statistically significant.

## Discussion of Methodological Advantages

The utilization of various assessment instruments guarantees a thorough examination of patient results. The VAS scale provides a dependable and subjective evaluation of pain, whereas EWHI delivers an objective appraisal of wound healing. Prior research has shown the efficacy of these instruments in analogous clinical environments, highlighting their dependability and precision (Kamma et al., 2009; Montevicchi et al., 2012).

The randomization technique mitigated selection bias, guaranteeing uniform distribution of demographic and clinical attributes among the groups. Furthermore, utilizing various surgical procedures in controlled settings facilitated a direct comparison of their effectiveness.

## Results

This section provides a comprehensive study of postoperative outcomes assessed by pain and wound healing across the three groups. The research employed the Visual Analogue Scale (VAS) to measure postoperative pain and the Early Wound Healing Index (EWHI) to evaluate wound healing efficacy on the seventh postoperative day. The data's statistical significance was assessed using ANOVA, accompanied by Tukey's post hoc test for pairwise comparisons.

### A. Pain Assessment (VAS)

The Visual Analogue Scale (VAS) scores, which range from 0 (no pain) to 10 (worst imaginable pain), were recorded for each patient to assess postoperative pain.

The mean VAS scores for the three groups are presented in Table.

**Group I (Scalpel)** had the highest mean VAS score ( $3.5 \pm 0.8$ ), indicating that patients in this group experienced the most postoperative pain.

**Group II (Electrocautery)** reported a significantly lower mean VAS score ( $2.3 \pm 0.6$ ), reflecting a substantial reduction in pain levels compared to Group I.

**Group III (Diode Laser)** demonstrated the lowest mean VAS score ( $1.8 \pm 0.5$ ), The table showing that patients in this group experienced the least postoperative pain.

The ANOVA test indicated a statistically significant difference in pain levels across the three groups ( $p < 0.001$ ). Pairwise comparisons indicated that both Group II and Group III reported considerably lower pain levels than Group I ( $p < 0.05$ ). Group III exhibited somewhat reduced pain levels compared to Group II; however, the difference lacked statistical significance ( $p > 0.05$ ).

### Wound Healing (EWHI)

The Early Wound Healing Index (EWHI) was utilized to evaluate the efficacy and rapidity of wound healing. This index evaluates healing on a scale from 1 (very poor) to 5 (excellent) based on color, bleeding upon touch, and granulation tissue.

**Group I (Scalpel)** exhibited the lowest mean EWHI score ( $2.5 \pm 0.7$ ), indicating slower and less efficient wound healing.

**Group II (Electrocautery)** showed improved healing with a mean EWHI score of  $3.8 \pm 0.6$ .

**Group III (Diode Laser)** achieved the highest mean EWHI score ( $4.2 \pm 0.5$ ), reflecting the most efficient wound healing.

ANOVA findings indicated a statistically significant difference in EWHI ratings among the three groups ( $p < 0.01$ ). Pairwise comparisons indicated that both

Group II and Group III exhibited significantly superior healing outcomes compared to Group I ( $p < 0.05$ ). The disparity in healing efficacy between Group II and Group III was not statistically significant ( $p > 0.05$ ).

This study's findings consistently demonstrate the enhanced efficacy of diode laser and electrocautery procedures over the traditional scalpel method regarding pain alleviation and wound healing. The diode laser group exhibited the lowest pain levels and the most effective wound healing; nonetheless, the differences between diode laser and electrocautery regarding wound healing were not statistically significant. These findings align with earlier research highlighting the benefits of minimally invasive techniques in minimizing tissue damage and improving recovery.

The superior pain alleviation in the diode laser and electrocautery cohorts can be ascribed to their capacity to reduce tissue damage and inflammation. The diode laser specifically forms a protective coagulum layer over the wound surface, serving as a biological dressing. This layer efficiently occludes the sensory nerve endings, resulting in less pain and discomfort. Both techniques enhance hemostasis, hence diminishing the likelihood of surgical problems and accelerating wound healing.

### **Discussion**

This study sought to assess the postoperative results of operculectomy surgeries executed using three different surgical methods: traditional scalpel, electrocautery, and diode laser. The results indicate that both electrocautery and diode laser much exceed the scalpel technique in minimizing postoperative pain and improving wound healing. These findings correspond with the increasing corpus of literature that supports the application of sophisticated surgical technology in soft tissue care.

### **Pain Reduction**

The notable decrease in pain levels seen in the electrocautery and diode laser groups can be ascribed to their distinct mechanisms of action. Electrocautery employs thermal energy to simultaneously incise and coagulate tissue, thereby reducing intraoperative hemorrhage and tissue damage. Research conducted by Saleh et al. (2018) and El-Kholey (2014) corroborates these findings, demonstrating that electrocautery yields less postoperative discomfort relative to conventional techniques. Diode lasers function at specified wavelengths that precisely target soft tissue while causing minimum collateral damage. This not only diminishes sensory nerve exposure but also facilitates expedited hemostasis and mitigates inflammatory response (Bornstein et al., 2015; Deppe et al., 2001).

The protein coagulum generated by the diode laser functions as a biological dressing, occluding sensory nerve endings and suppressing the release of pain-inducing mediators (Kumar et al., 2015; Romanos et al., 2004). These characteristics elucidate why individuals in the diode laser cohort had the minimal pain levels. This aligns with the findings of Dilsiz et al. (2013), who discovered that laser-assisted procedures markedly diminish postoperative discomfort.

### **Wound Healing**

The Early Wound Healing Index (EWHI) indicated that wound healing was significantly superior in the electrocautery and diode laser cohorts. Electrocautery minimizes tissue stress and facilitates rapid coagulation, so establishing an ideal environment for tissue restoration. Studies by Khadra et al. (2005) and Gutknecht et al. (2008) demonstrate that electrocautery enhances wound healing by diminishing the inflammatory response and promoting granulation tissue development.

Diode lasers accelerate healing via their biostimulatory properties. They enhance fibroblast activity, collagen production, and angiogenesis, which are essential for fast tissue regeneration (Sulewski, 2000; Parker, 2007). Tuncer et al. (2015) verified these outcomes, revealing that laser-assisted wounds had accelerated epithelialization and decreased edema relative to traditional treatments.

### **Clinical Implications**

The results of this investigation possess considerable clinical significance. Diode laser and electrocautery are recommended as the preferred procedures for operculectomy because of their improved postoperative results. This is especially crucial in situations when patient comfort and swift recovery are emphasized. The diode laser, although costlier, provides advantages like antibacterial qualities and reduced scarring, rendering it an optimal selection for soft tissue procedures (Moritz et al., 2006; Schwarz et al., 2008).

### **Limitations and Future Research**

Notwithstanding the encouraging outcomes, this study possesses specific limitations. The sample size was modest, and the follow-up duration was restricted to seven days. Subsequent research should use bigger sample numbers and prolonged follow-up periods to comprehensively evaluate long-term consequences. Additionally, split-mouth designs could provide more robust comparisons by eliminating inter-patient variability (Slot et al., 2011; Walsh et al., 2013).

### **Conclusion**

This study presents strong evidence that diode laser and electrocautery techniques markedly enhance postoperative results in operculectomy surgeries relative to the traditional knife method. Both improved approaches exhibited enhanced efficacy in alleviating postoperative pain and promoting wound healing

throughout a seven-day follow-up period. The diode laser technique, although not statistically more effective than electrocautery in wound healing, demonstrated the lowest pain levels, so affirming its utility as a minimally invasive instrument.

The diode laser's capacity to generate a biological dressing over the wound not only alleviates pain but also promotes an optimal environment for accelerated and effective tissue regeneration. Electrocautery, due to its thermal coagulative characteristics, offers a comparable decrease in tissue damage and inflammatory reaction, rendering it a dependable alternative. These findings align with previous research, highlighting the benefits of incorporating modern surgical instruments in dental treatment.

Although the initial expenses of diode laser apparatus may provide an obstacle, its advantages regarding patient comfort, less necessity for postoperative care, and expedited healing render it a cost-effective choice over time. This is especially pertinent in high-demand clinical environments where patient throughput and satisfaction are essential.

Subsequent study should seek to corroborate these findings by utilizing bigger sample numbers and prolonged follow-up durations to assess long-term consequences. The incorporation of split-mouth designs will mitigate inter-patient variability and yield more robust comparative results. Moreover, examining patient-reported outcomes, including quality of life and happiness, will yield a comprehensive understanding of the advantages of these new approaches.

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**Legend Tables**

Table 1. Demographic Characteristics of Study Participant

Group	Mean Age (Years) ± SD	Male	Female	Mean VAS ± SD	Mean EWHI ± SD	p-value (ANOVA)
Scalpel (Group I)	28.3 ± 5.6	4	4	3.5 ± 0.8	2.5 ± 0.7	<0.001 (VAS), <0.01 (EWHI)
Electrocautery (Group II)	27.1 ± 6.3	3	5	2.3 ± 0.6	3.8 ± 0.6	
Diode Laser (Group III)	29.0 ± 4.9	5	3	1.8 ± 0.5	4.2 ± 0.5	
Total	28.1 ± 5.6	12	12			

Group	Mean VAS ± SD	Pairwise Comparison (p-value)	Mean EWHI ± SD	Pairwise Comparison (p-value)
Scalpel (Group I)	3.5 ± 0.8	Reference	2.5 ± 0.7	Reference
Electrocautery (Group II)	2.3 ± 0.6	<0.05 vs. Group I	3.8 ± 0.6	<0.05 vs. Group I
Diode Laser (Group III)	1.8 ± 0.5	<0.05 vs. Group I; >0.05 vs. Group II	4.2 ± 0.5	<0.05 vs. Group I; >0.05 vs. Group II