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Comparative Evaluation of Carbon Dioxide and Diode Laser-Assisted Operculectomy in the Management of Pericoronitis: A Case Report

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Background*: Pericoronitis involving the operculum of a partially erupted mandibular third molar is a common indication for minor oral surgery. Operculectomy performed using conventional methods may be associated with bleeding and postoperative discomfort. Soft-tissue lasers provide potential advantages through precise tissue ablation and hemostasis. This case series compares the clinical outcomes of carbon dioxide (CO_2) and diode laser-assisted operculectomy in patients with pericoronitis.*

Case Presentation: *Four patients with pericoronitis underwent laser-assisted operculectomy under local anesthesia. Two patients were treated using a CO_2 laser (10,600 nm, 7 W, continuous wave), while two were treated using a diode laser (940 nm, 7 W, continuous wave). Intraoperative bleeding and operating time were recorded. Postoperative pain was assessed using the Visual Analog Scale (VAS) on postoperative day 0, day 7, and at one month. Healing and scar quality were evaluated using the Vancouver Scar Scale (VSS) and Stony Brook Scar Scale (SBSS).*

Results*: No complications or suturing were required in any patient. Intraoperative bleeding was absent in both CO_2 laser cases, whereas mild bleeding occurred in both diode laser cases. Operating time was shorter with the CO_2 laser. Mean VAS scores on postoperative day 0 were lower in the CO_2 group than in the diode group (3.5 vs. 7.0), with corresponding scores of 1.5 and 4.0 on day 7. All patients reported no pain at one month. At one month, both CO_2-treated patients achieved optimal VSS and SBSS scores. One diode-treated patient also achieved optimal scores, while the other demonstrated mild residual scar changes.*

Conclusion: *Within the limitations of this small case series, CO_2 laser-assisted operculectomy demonstrated favorable outcomes compared with diode laser treatment, particularly in terms of intraoperative hemostasis, operating time, early postoperative pain, and short-term scar quality. Larger controlled studies with longer follow-up are required to validate these findings.*

Key Word*: Pericoronitis; Operculectomy; Carbon dioxide laser; Diode laser; VAS; Vancouver Scar Scale; Stony Brook Scar Scale; Oral surgery.*

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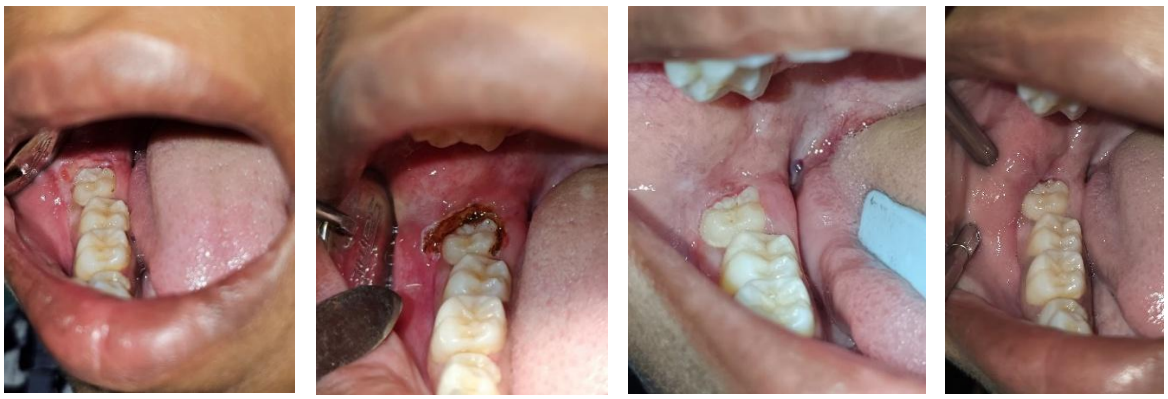
I. INTRODUCTION

Pericoronitis is inflammation of the soft tissue, or operculum, surrounding the crown of a partially erupted tooth, most often the mandibular third molar, and is one of the most common indications for minor oral surgical intervention.[1] Operculectomy, the surgical excision of the inflamed operculum, has traditionally been performed with a scalpel or electrocautery, both of which are associated with intraoperative bleeding, postoperative discomfort, and variable healing. Soft-tissue lasers, including the carbon dioxide CO2 (LazerSmile® - STPL Sahajanand Technologies Private Limited) and diode laser (Indilase by Medsol), offer a comparatively bloodless, minimally invasive alternative with reported advantages in hemostasis and patient comfort, although their relative performance for operculectomy has not been well documented. This case report compares the intraoperative and postoperative outcomes of CO2 laser- versus diode laser-assisted operculectomy in four patients with pericoronitis.

II. CASE REPORT

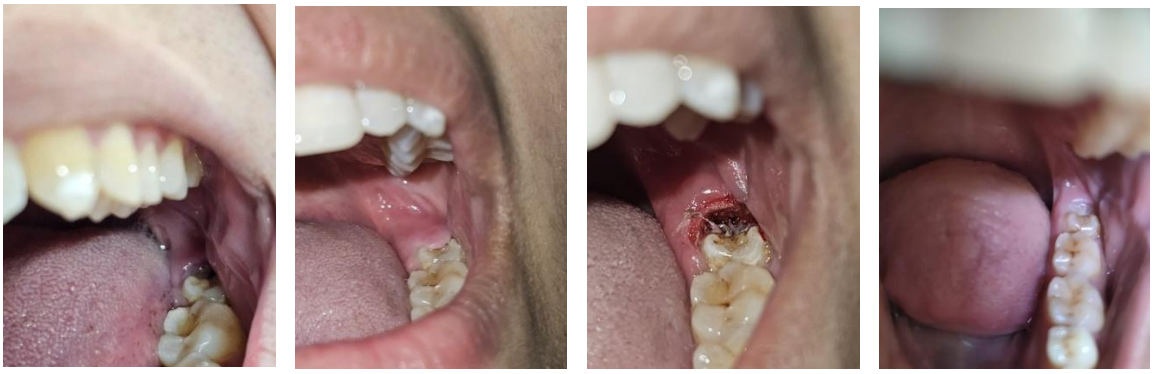
Four patients presenting with pericoronitis underwent laser-assisted operculectomy under local anesthesia. Two patients were treated with a CO2 laser operating at a wavelength of 10,600 nm and a power output of seven watts

in continuous wave mode. The remaining two patients were treated with a diode laser operating at a wavelength of 940 nm, also at seven watts in continuous wave mode. In both groups, the inflamed operculum overlying the involved tooth was ablated under direct vision; no sutures were required, and standard postoperative instructions were provided. No intraoperative or postoperative complications were recorded in any patient.



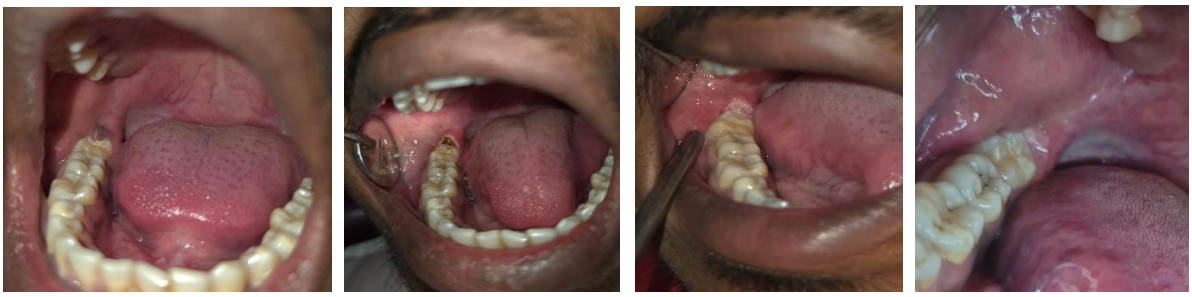
(a) (b) (c) (d)

Figure 1: Clinical photographs of patient 1 (CO2 laser group) showing (a) preoperative, (b) POD – 1, (c) POD – 7, (d) 1 Month postoperative views of the operculectomy site.



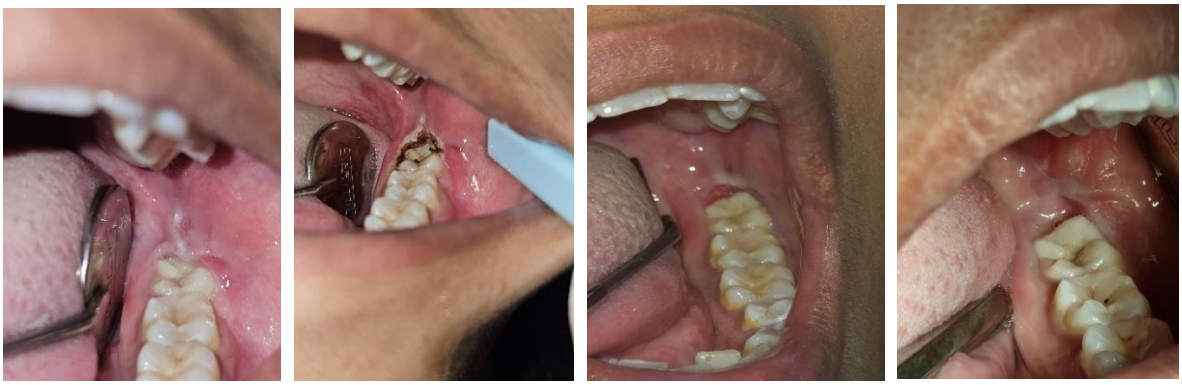
(a) (b) (c) (d)

Figure 2: Clinical photographs of patient 2 (CO2 laser group) showing (a) preoperative, (b) POD – 1, (c) POD – 7, (d) 1 Month postoperative views of the operculectomy site.



(a) (b) (c) (d)

Figure 3: Clinical photographs of patient 2 (diode laser group) showing (a) preoperative, (b) POD – 1, (c) POD – 7, (d) 1 Month postoperative views of the operculectomy site.



(a) (b) (c) (d)

Figure 3: Clinical photographs of patient 2 (diode laser group) showing (a) preoperative, (b) POD – 1, (c) POD – 7, (d) 1 Month postoperative views of the operculectomy site.

Intraoperative bleeding was absent in both CO2 laser cases, whereas mild bleeding was observed during both diode laser procedures. Operating time to complete the operculectomy was also shorter with the CO2 laser than with the diode laser in this series.

Postoperative pain was assessed with the Visual Analog Scale (VAS) at postoperative day zero, postoperative day seven, and one month. In the CO2 group, Patient 1 scored four, two, and zero, and Patient 2 scored three, one, and zero. In the diode group, Patient 1 scored six, three, and zero, and Patient 2 scored eight, five, and zero. Mean day-zero pain was therefore lower in the CO2 group (3.5) than in the diode group (7.0); this gap narrowed by one week (mean 1.5 versus 4.0) before both groups reached a score of zero at one month.

Scarring was evaluated with the Vancouver Scar Scale (VSS), which grades vascularity, pigmentation, pliability, and height (each 0–3, lower being more favorable),[2] and the Stony Brook Scar Scale (SBSS), which grades width, height, color, hatch or suture marks, and overall appearance (each 0 or 1, with five being the most favorable composite score).[3] At postoperative day zero, all four patients had an identical composite VSS of twelve and an SBSS of zero, reflecting the expected acute appearance of freshly ablated tissue. By one week, VSS had fallen to four and six in the two CO2 patients, compared with eight and seven in the two diode patients, while SBSS had risen to two and one with CO2 versus two and zero with diode. At one month, both CO2 patients reached the most favorable possible scores, a VSS of zero and an SBSS of five, indicating a scar indistinguishable from surrounding tissue. Of the two diode patients, one likewise reached a VSS of zero and an SBSS of five, while the other retained a residual VSS of two, reflecting slight residual vascularity and pigmentation change, and an SBSS of four, reflecting a marginally poorer overall appearance rating.

III. DISCUSSION

The findings in this small series are consistent with the known tissue interactions of the two wavelengths used. The CO2 laser, at 10,600 nm, is preferentially absorbed by intracellular and extracellular water, providing contactless tissue ablation, minimizing mechanical tissue manipulation while allowing precise incision and controlled vaporization of soft tissues with near-immediate coagulation of small-caliber vessels;[4,5] this property likely explains the bloodless intraoperative field and shorter operating time observed with the CO2 laser in the present cases. The diode laser, at 940 nm, is absorbed principally by hemoglobin and melanin and penetrates more deeply into soft tissue,[6,7] diode laser generates a concentrated beam of light with different wavelengths which heats the tip of laser which may account for the mild intraoperative bleeding and comparatively longer operating time noted with this laser.

The lower VAS scores recorded with the CO2 laser, particularly on the day of surgery, may similarly reflect a more superficial zone of thermal effect and reduced lateral thermal spread, allowing more selective sealing of exposed nerve endings. The deeper penetration characteristic of the diode wavelength may instead produce greater collateral thermal injury, contributing to the higher early postoperative pain reported by both diode-treated patients; this difference nevertheless resolved in all patients by one month. A comparable pattern was noted for scarring, with both CO2 patients achieving an optimal one-month VSS and SBSS, while one diode patient showed a modest residual deficit in vascularity, pigmentation, and overall cosmetic appearance. This trend is broadly consistent with reports describing more favorable short-term hemostasis, precision, and healing with the CO2 laser relative to the diode laser in other oral soft-tissue procedures,[4,8,9] although operculectomy

specifically has been compared less often, and other treatment modalities for pericoronitis warrant similar prospective evaluation.[10]

This report is limited by the small sample size of two patients per laser type and by follow-up restricted to one month, which precludes statistical comparison or firm conclusions regarding superiority of either modality. Larger, controlled studies with longer follow-up are needed to confirm these observations and to define optimal laser parameters for this indication.

IV. CONCLUSION

Within the limitations of this small case series, the CO2 laser appeared to offer an advantage over the diode laser in intraoperative hemostasis, operating time, early postoperative pain, and short-term scar quality for operculectomy in pericoronitis.

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