

INTRODUCTION

Diode lasers with non-initiated tips can be used for implant surface decontamination in peri-implantitis therapy.

MATERIALS & METHODS

Bovine tongue slices with 5 mm thickness were placed in between two microscopy glass slides, in a 11 cm distance from a thermographic camera with the direction of the camera view perpendicular to the long axis of the histology slides. Fifteen tissue specimens (n=15) were cut with 2 cm long incisions along the surface of the parallel to the glass slides and the camera capture field (Fig. 1).

The incisions were performed using a 980nm diode laser (continuous wave at 2 watts) with 320µm-thick glass non-initiated fiber tip for a 30 second irradiation period (power density: 2,488 W/cm²) (Fig . 4). The temperature changes in °C (ΔT) at 10 seconds, 20 seconds, and 30 seconds, as well as the vertical height and horizontal width heat transfer (in mm), were recorded at 10-second intervals (Fig. 2)(Fig. 3). The ΔT and the amount of lateral and vertical irradiance was measured using the thermographic images and a special image analysis software in 10-second intervals, for a total of 30 second irradiation period (Fig. 5).



Fig. 1. Thermography camera is placed perpendicularly to the horizontal plane of the tissue, with 5mm thickness of bovine tissue placed between the glass slides. The sample is stabilized with clear tape to a flat surface, as the 980nm laser non-initiated glass fiber tip is incising the tissue in a horizontal manner.

OBJECTIVES

The purpose of this study was to demonstrate temperature changes and thermal irradiance pattern in soft tissues, using the 980nm-diode laser with non-initiated tips, utilizing the use of thermography.

RESULTS

Change in Temperature (°C) During Irradiation

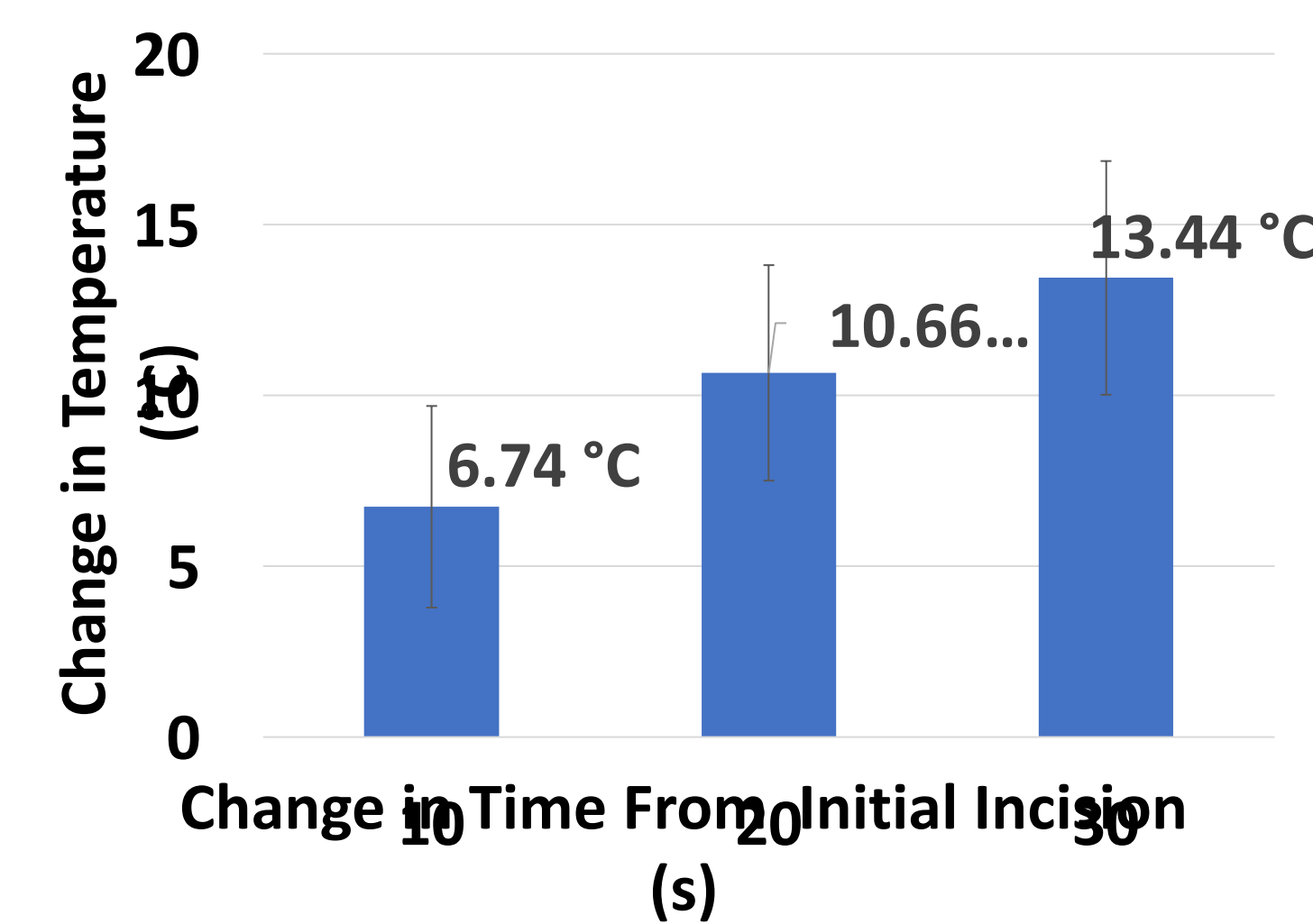


Fig. 2. Change in maximum temperature of the soft tissues over a period of irradiation

Irradiance of Soft Tissues (mm)

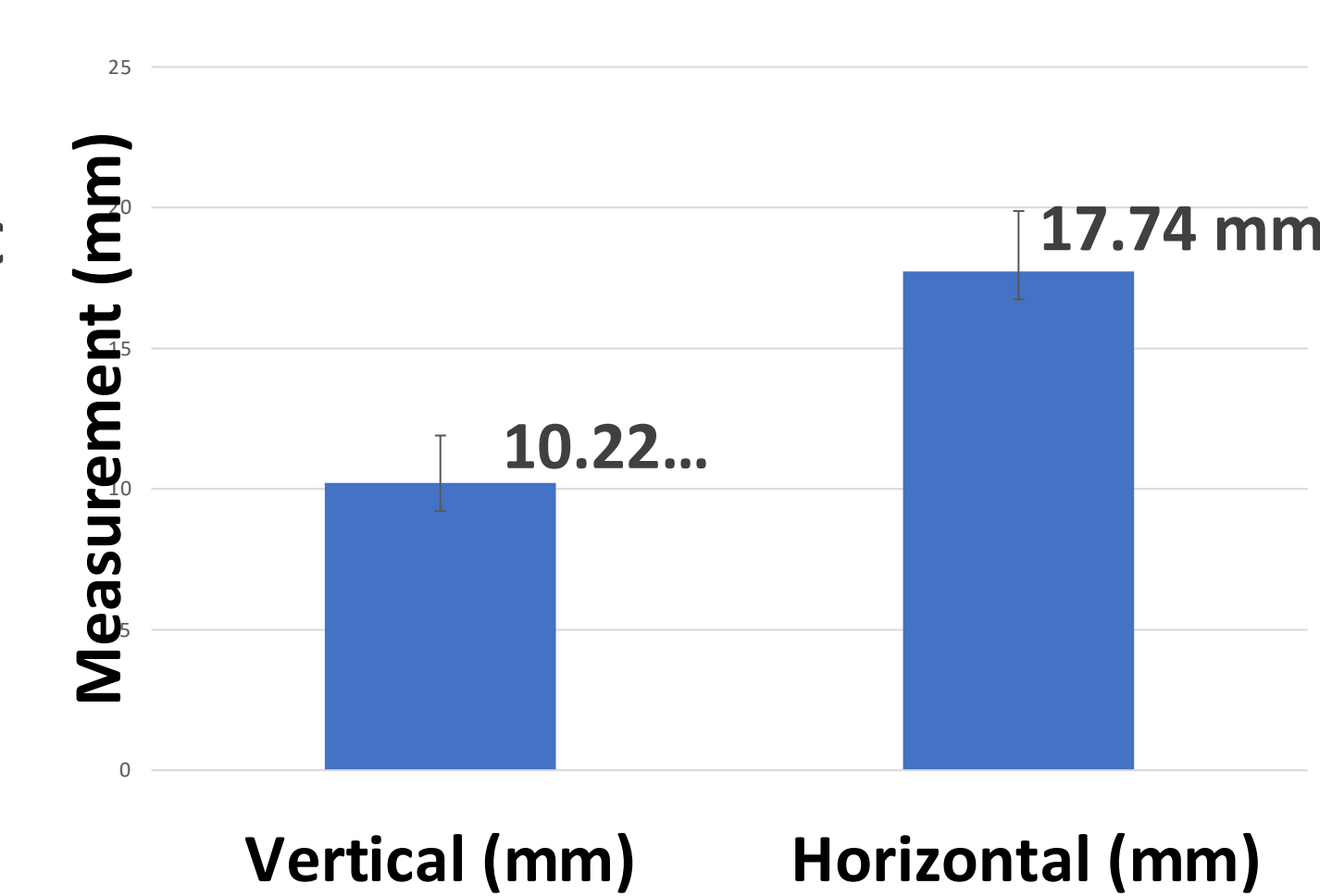


Fig. 3. Vertical and horizontal measurements of heat transfer

Table 1. Average Temperature at Time of Irradiation

Time (sec)	0	10	20	30
Temperature (°C)	17.86 ± 1.18°C	24.63 ± 2.87°C	28.52 ± 2.98°C	31.29 ± 3.04°C
ΔT from 0s	N/A	6.73 ± 2.95°C	10.66 ± 3.15°C	13.4 ± 3.42°C

Table 2. Irradiance at 30sec Irradiation

Vertical	Horizontal
10.22±1.68mm	17.74±2.14mm



Fig. 4. Post-irradiation of soft tissues isolated between glass histology slides, stabilized with tape on a flat surface. Incision of 2cm length shows carbonization

THERMOGRAPHIC IMAGES

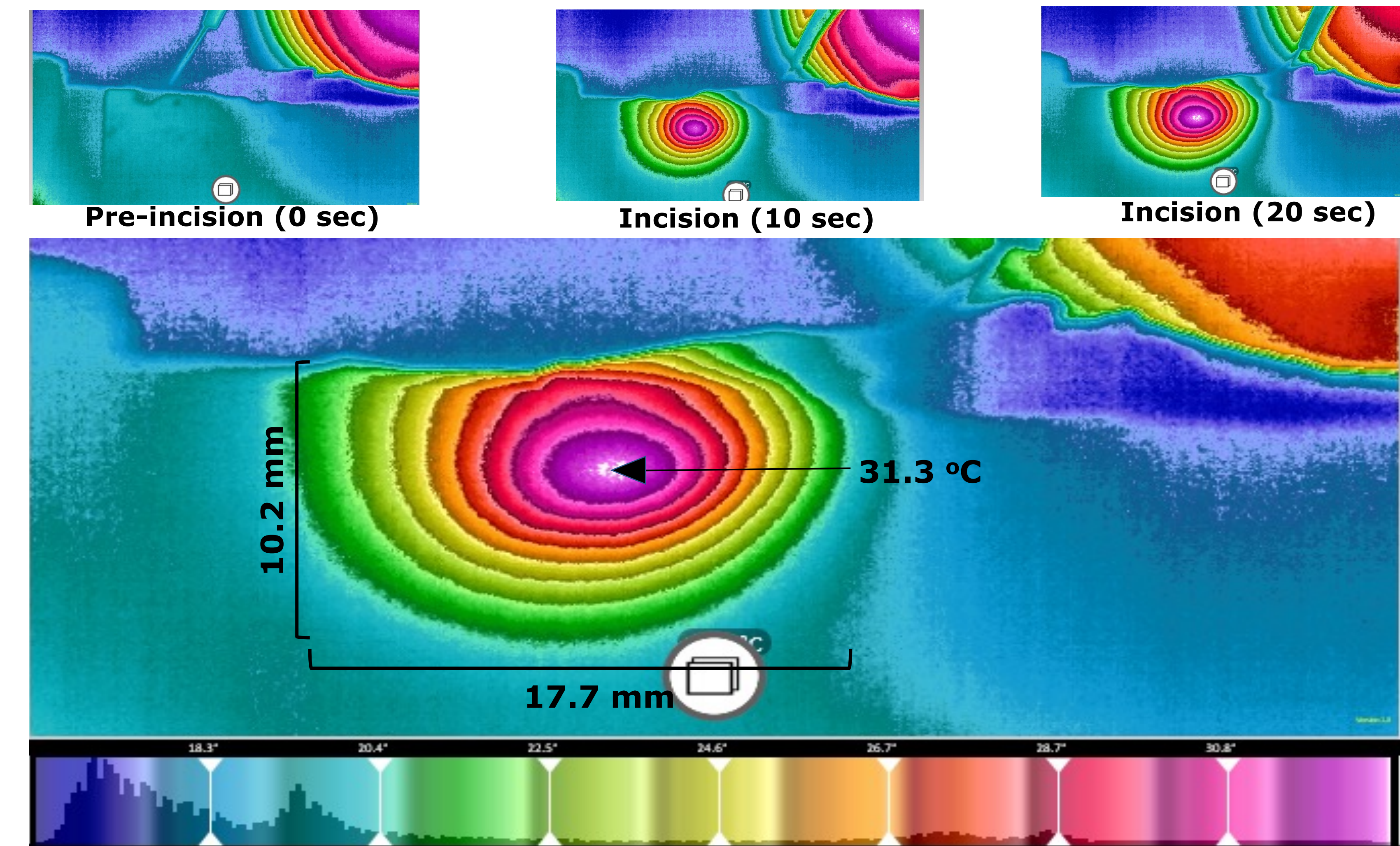


Fig. 5. Thermographic pattern at 30 sec. demonstrating irradiance with continuous 2cm horizontal incisions. Temperature of room (light blue): 17.9 °C, resting bovine tissue temperature (teal): 18.3 °C, maximum temperature of the tissue (white): 31.3 °C, lateral irradiance: 17.7 mm, vertical irradiance 10.2 mm.

CONCLUSION

Non-initiated tips of 980nm laser present deep penetration depth and high temperatures in bovine soft tissues. Irradiation period and clinical indication must be strictly followed to avoid complications from overheating.

REFERENCES

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