

INTRODUCTION

Lasers have been used in the management of peri-implantitis of titanium dental implants, but there is no evidence about the thermal changes that occur within titanium and ceramic (Zr) implants during irradiation.

OBJECTIVE

The aim of this study was to compare the thermal effects of a 445nm blue laser light on titanium and ceramic implants.

STUDY DESIGN

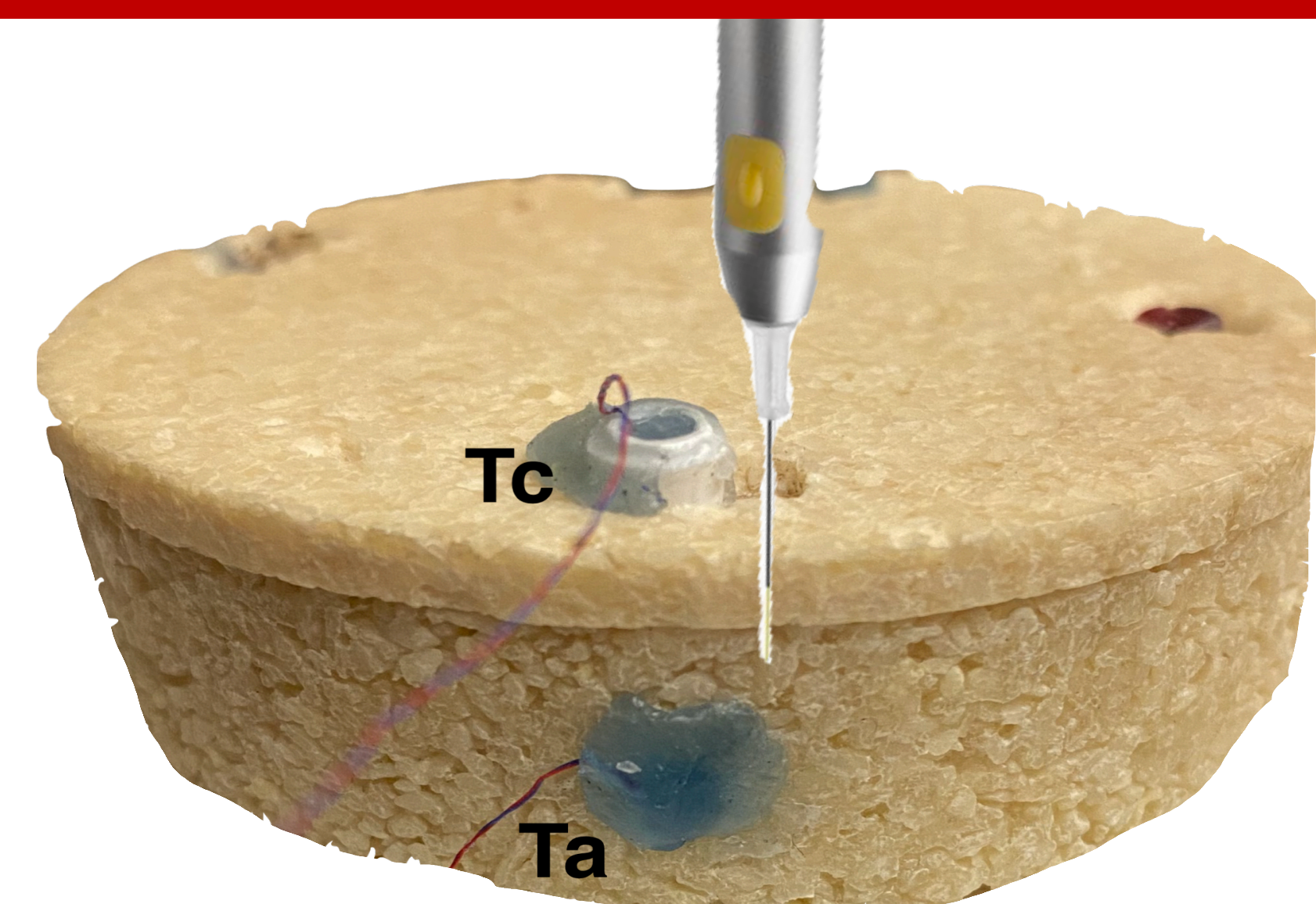


Figure 1. Position of thermocouples and laser tip inside of the intra-bony defect.

METHODS

A titanium (Ti) and ceramic (Zr) dental implant were placed into an organic bovine bone analog, and a 3-wall intra-bony defect was created (3x5x6mm). Two thermocouples were used to record temperature changes at the coronal and apical implant portions (Fig. 1). The tip of the 445nm diode laser was positioned parallel to the implant, and the defect was irradiated for 30 seconds at 2W in continuous mode and pulsed mode (tip diameter, 320 μ m). The temperature changes were recorded, and a statistical comparison with the t-test was conducted.

RESULTS

The temperature changes that occurred on the coronal and apical portions of the titanium (Ti) and ceramic (Zr) implants are included in the table below. Overall, the titanium implant showed higher ($P<0.001$) temperature changes at the coronal and apical levels in comparison to the ceramic implant, and the results were statistically significant (Table 1, Figs. 2, 3).

Table 1	Continuous Mode		Pulsed Mode	
	Coronal ΔT ($^{\circ}C$)	Apical ΔT ($^{\circ}C$)	Coronal ΔT ($^{\circ}C$)	Apical ΔT ($^{\circ}C$)
Titanium (Ti)	29.6 $\pm$ 0.28 	6.70 $\pm$ 0.55	16.7 $\pm$ 1.46 	3.19 $\pm$ 0.28
P value	< 0.001	< 0.001	< 0.001	< 0.001
Ceramic (Zr)	26.4 $\pm$ 2.07 	5.20 $\pm$ 0.85	12.1 $\pm$ 0.69 	2.57 $\pm$ 0.53
P value	< 0.001	< 0.001	< 0.001	< 0.001

445nm Continuous Mode

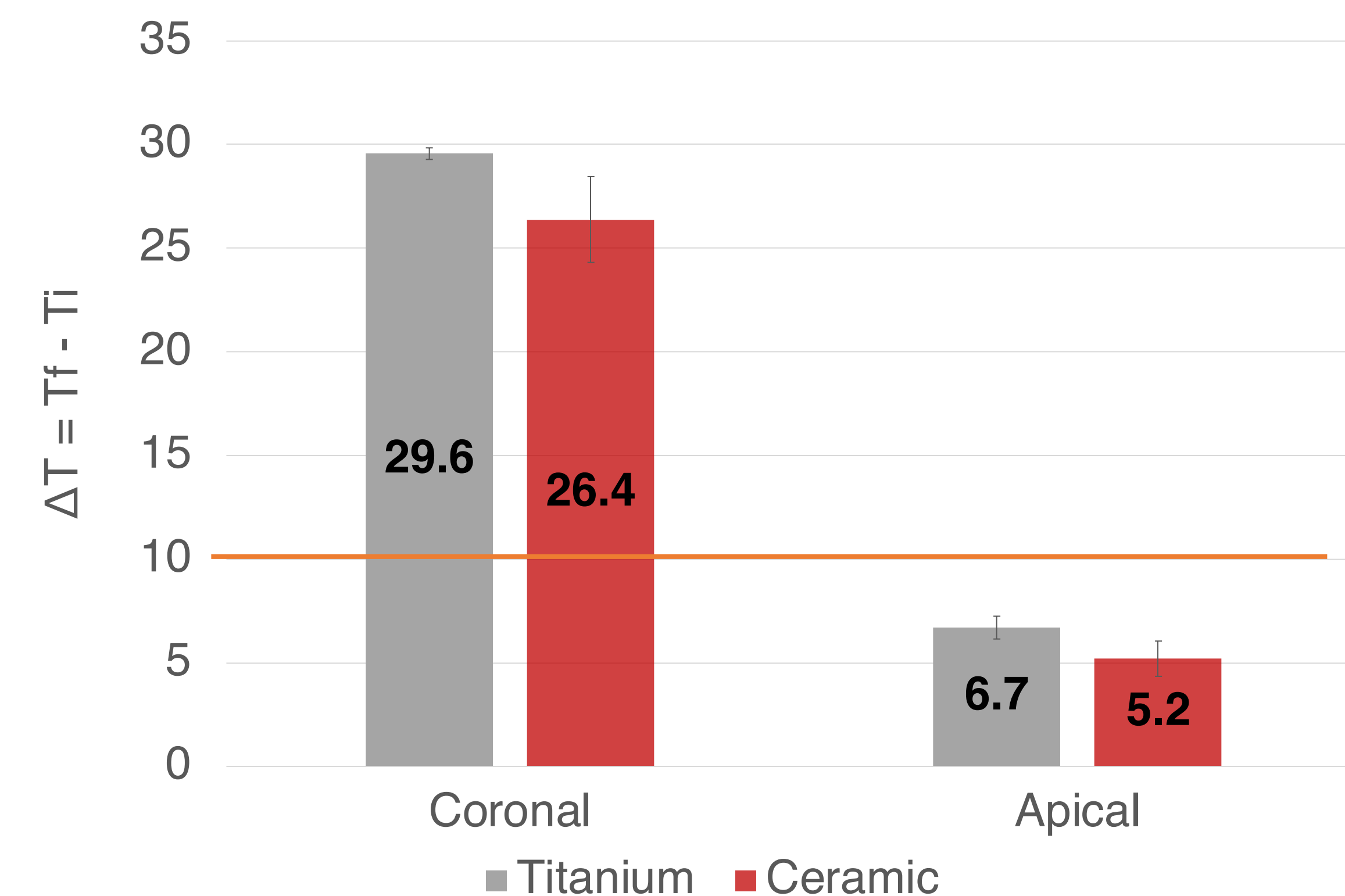


Figure 2. Average ΔT values after 30 seconds of irradiation using 445nm in 2W c.w.

445nm Pulsed Mode

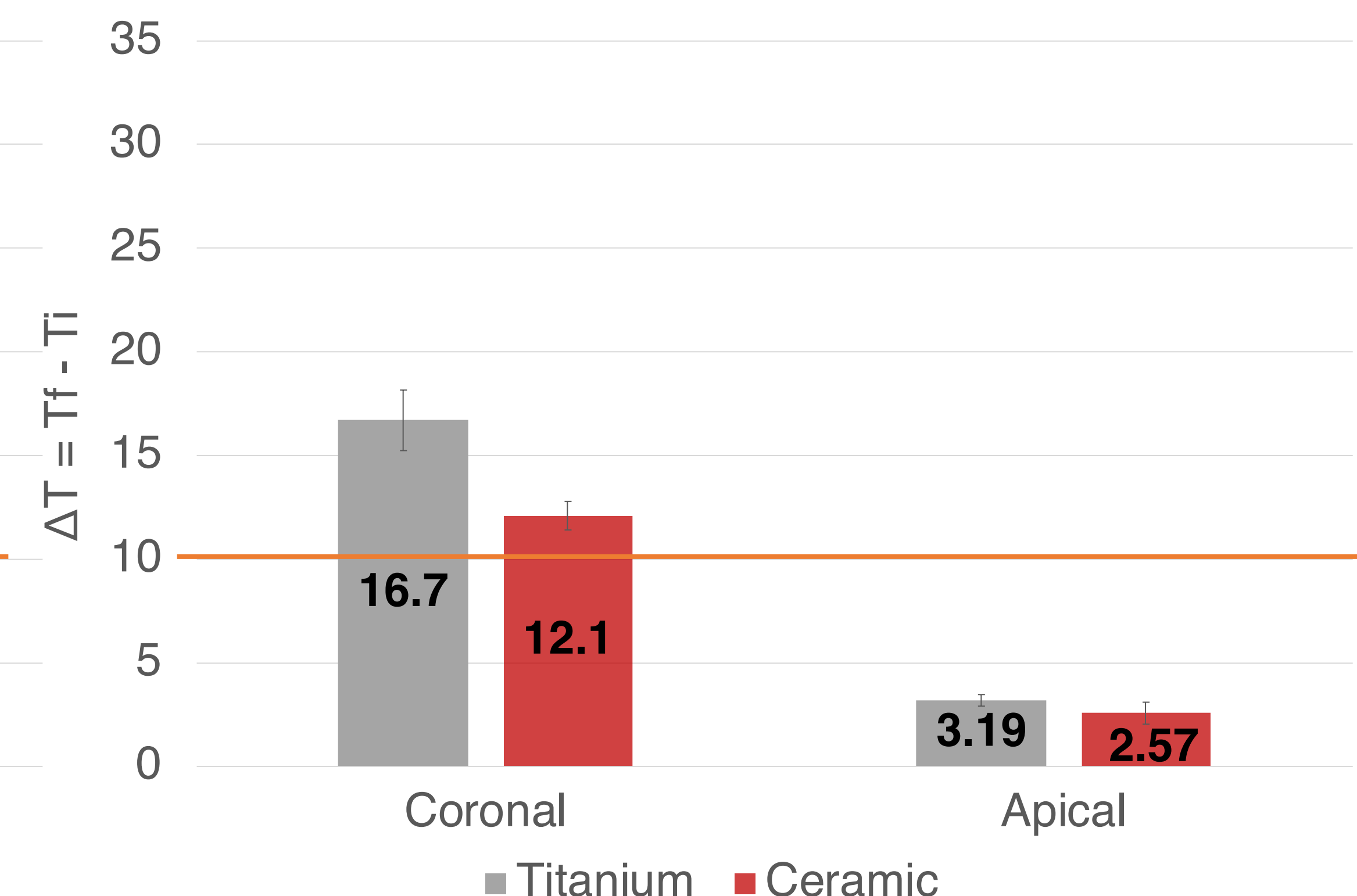


Figure 3. Average ΔT values after irradiation with 2W, 445nm in pulsed mode.

CONCLUSION

The titanium and ceramic implants reached critical threshold ($\Delta 10^{\circ}C$) within 30 seconds of irradiation in 2W c.w. or pulsed mode, therefore, the 445nm blue laser light should be used with caution when treating peri-implant defects in clinical settings, especially on titanium implants.