

## PURPOSE

Compare the antimicrobial efficacy of diode lasers (970 nm, 660 nm), Er:YAG laser (2940 nm), and PDT against Staphylococcus aureus biofilms on titanium implant surfaces in addition to assessing potential alterations post-treatment with laser on surface morphology and chemical composition of implants.

## METHODS

This study included 16 sandblasted, large-grit, acid-etched titanium dental implants. About 15 implants were inoculated with Staphylococcus aureus and randomly allocated into five groups (n = 3):

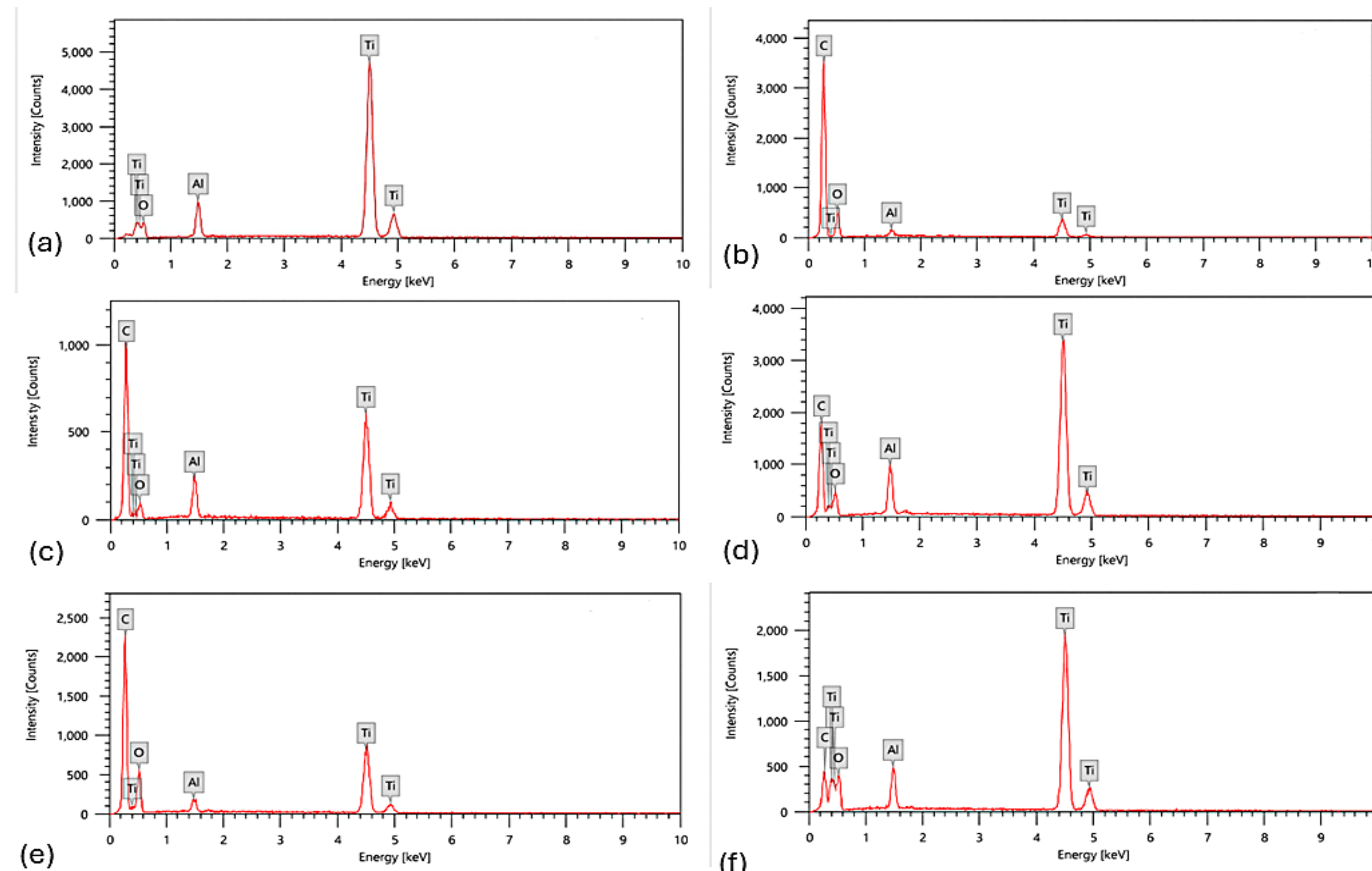
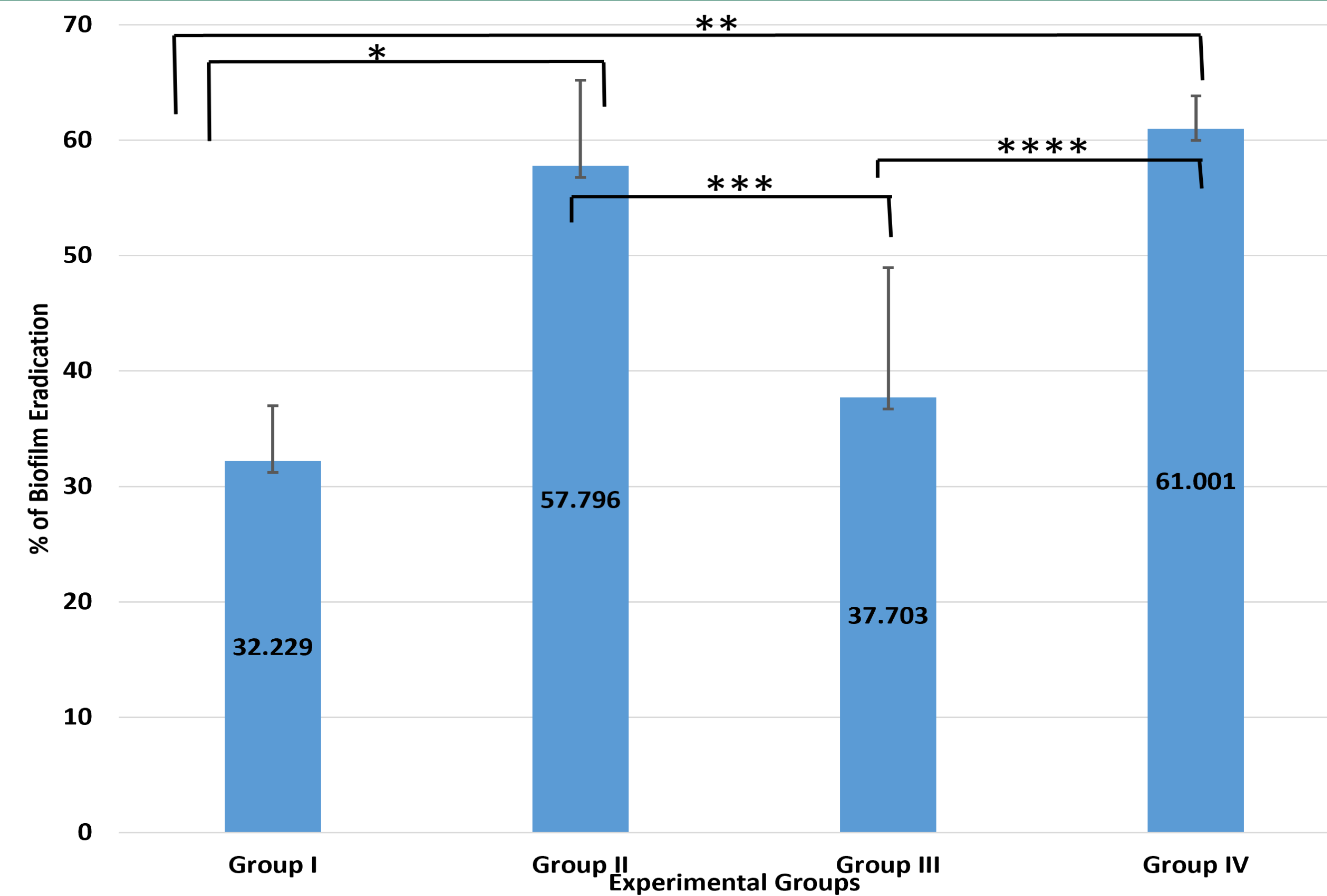
- Group I** (diode 970 nm)
- Group II** (diode 660 nm + methylene blue (MB) PDT)
- Group III** (Er:YAG 2940 nm)
- Group IV** (diode 970 nm + MB PDT + diode 660 nm)
- Group V** control with no laser treatment. One sterile implant served as a negative control.

**Biofilm removal** was quantified via crystal violet staining and spectrophotometric measurement at OD<sub>570</sub>.

**Surface changes** were evaluated using scanning electron microscopy (SEM) and energy-dispersive X-ray spectroscopy (EDX).

The normality of data distribution was assessed using the Shapiro–Wilk test. Normally distributed data (mean optical density at 570 nm (OD<sub>570</sub>) and the percentage of biofilm eradication were compared using a one-way analysis of variance (ANOVA), followed by Tukey’s post hoc test for pairwise comparisons. P-value of <0.05 was considered statistically significant.

## CLINICAL REPORT



Negative control (Sterile implant)

Positive control

Group I

Group II

Group III

Group IV

## RESULTS

**Group IV** exhibited the highest biofilm eradication (61%), followed by Group II (57.8%), with significant differences compared to other groups (P < 0.05).

**SEM analysis** confirmed effective biofilm removal in Groups II and IV with minimal surface alteration.

**Group I & III:** indicating partial eradication of the S. aureus biofilm. **In groups II and IV:** indicating effective biofilm eradication. Surface morphology was likely to be that of the original implant.

**EDX** revealed that titanium and oxygen content increased significantly in Groups II and IV, while carbon content, indicative of organic residue, decreased, supporting the treatments' non-destructive nature.

## CONCLUSIONS

Combined diode laser and PDT protocols (especially in Group IV) demonstrated superior biofilm eradication with minimal adverse effects on implant surface integrity.

This synergistic approach may represent an effective adjunctive therapy for managing peri-implantitis.

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