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Bactericidal Effect of GaAIAs Laser on Anaerobic Photosensitized Periodontopathics- An In Vitro Study

AayshaTabinda Nabi[1], Aasia Ahsan[2], Prabhat Kumar Singh[3], Toshi[4], Manisha Mallik[4], Anindita Banerjee[5]

[1]Reader, Department of Periodontology, Buddha Institute of Dental Sciences and Hospital Patna.
[2]Senior Lecturer, Department of Prosthodontics, Buddha Institute of Dental Sciences and Hospital Patna.
[3]Professor, Department of Periodontology, Buddha Institute of Dental Sciences and Hospital Patna.
[4]Senior Lecturer, Department of Periodontology, Buddha Institute of Dental Sciences and Hospital Patna.
[5]Professor & HOD, Department of Periodontology, Buddha Institute of Dental Sciences and Hospital Patna.

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ABSTRACT

Background: The mainstay of periodontal therapy remains the physical removal of subgingival plaque. The present study was conducted to determine bactericidal effect of GaAIAs laser on anaerobic photosensitized periodontopathics. **Materials & Methods:** The present study was conducted on 60 adult patients of both genders of chronic periodontitis (Group I). Equal number of controls was also selected (Group II). In all patients subgingival plaque samples were collected. Samples were cultured anaerobically for 72 h at 37°C on blood agar, Brewer's agar culture plates. Bacteria were identified based on colony characteristics, hemolysis, pigmentation, and fluorescence. **Results:** The mean P. gingivalis count (CFU/ml) during undilution in group I was 302.4 and in group II was 401.5, at 1:10 was 204.5 in group I and 328.2 in group II, at 1:50 was 115.2 in group I and 276.3 in group II, at 1:100 was 27.8 in group I and 132.8 in group II. The difference was significant (P< 0.05). The mean F. nucleatum count (CFU/ml) during undilution in group I was 212.4 and in group II was 291.5, at 1:10 was 125.5 in group I and 217.2 in group II, at 1:50 was 68.2 in group I and 150.3 in group II, at 1:100 was 17.8 in group I and 94.8 in group II. The difference was significant (P< 0.05).**Conclusions:** Authors found that GaAIAs laser found to be effective in reducing periodontal pathogens.

Keywords: GaAIAs laser, Periodontal, Fusobacteriumnucleatum.

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INTRODUCTION

Periodontal diseases are chronic infectious condition resulting from accumulation of bacterial biofilm on the tooth surface below the level of gingival margin.[1] The mainstay of periodontal therapy remains the physical removal of subgingival plaque. However, mechanical therapy alone may fail to eliminate the pathogenic bacteria because of their location within gingival tissue or in other areas inaccessible to periodontal instrumentation.[2] These limitations and the improved biological understanding of periodontal diseases have led to a move in emphasis from a pure mechanical approach to other methods which include the use of antiseptics and antibiotics. Besides the development of resistance, other problems associated with these adjunctive pharmacological regimes are disruption of microflora of oral cavity and gastrointestinal tract.[3]

Name & Address of Corresponding Author
Dr. Aasia Ahsan
Senior Lecturer,
Department of Prosthodontics,
Buddha Institute of Dental Sciences and Hospital
Patna.

Gallium aluminium arsenide (GaAlAs) laser is characterized by an irreversible fall in output power together with associated facet damage. The importance of near-field uniformity in interpreting catastrophic degradation is described. The power emission per unit area should primarily determine the onset of catastrophic degradation.[4] It is shown that, when the effect of such factors as the near-field uniformity and internally circulating modes are taken into account, good agreement is obtained between the effective optical width and the limit of catastrophic degradation. The idea of sensitizing bacterial cells to killing by otherwise harmless doses of visible light has been used as the basis of new therapeutic modality known as photodynamic therapy (PDT).[5] The present study was conducted to determine bactericidal effect of GaAIAs laser on anaerobic photosensitized periodontopathics.

MATERIALS & METHODS

The present study was conducted in the department of Periodontics. It comprised of 60 adult patients of both genders of chronic periodontitis (Group I). Equal number of controls was also selected (Group II). Ethical approval was obtained prior to the study.

All patients were informed and written consent was obtained.

Data such as name, age, gender etc was recorded. In all patients subgingival plaque samples were collected. Samples were cultured anaerobically for 72 h at 37°C on blood agar, Brewer's agar culture plates. After 72 h, growth of bacterial colonies was seen on culture plates. Two bacteria were Porphyromonasgingivalis and Fusobacteriumnucleatum. Bacteria were identified based on colony characteristics, hemolysis, pigmentation, and fluorescence. Results thus obtained were subjected to statistical analysis. P value less than 0.05 was considered significant.

RESULTS

Table 1: Distribution of patients

Groups	Group I	Group II
Status	Chronic periodontitis	Control
Number	60	60

[Table 1] shows that group I contained chronic periodontitis patients and group II were healthy (control).

Table 2: Bactericidal effect of Galium Arsenic (Ga-As) laser on P. gingivalis

Dilution concentration	Group I	Group II	P value
Undiluted	302.4	401.5	0.001
Dilution 1:10	204.5	328.2	
Dilution 1:50	115.2	276.3	
Dilution 1:100	27.8	132.8	

[Table 2, Figure 1] shows that mean P. gingivalis count (CFU/ml) during undilution in group I was 302.4 and in group II was 401.5, at 1:10 was 204.5 in group I and 328.2 in group II, at 1:50 was 115.2 in group I and 276.3 in group II, at 1:100 was 27.8 in group I and 132.8 in group II. The difference was significant (P< 0.05).

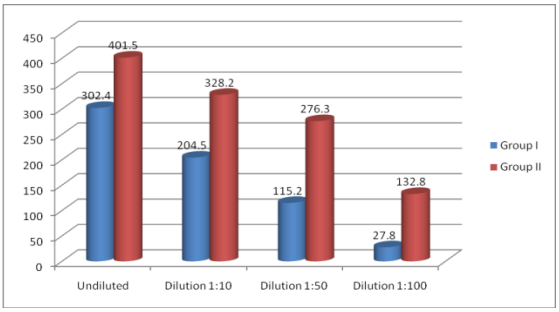

Figure 1: Bactericidal effect of Galium Arsenic (Ga-As) laser on P. gingivalis

Table 3: Bactericidal effect of Galium Arsenic (Ga-As) laser on F. nucleatum

Dilution concentration	Group I	Group II	P value
Undiluted	212.4	291.5	0.001
Dilution 1:10	125.5	217.2	
Dilution 1:50	68.2	150.3	
Dilution 1:100	17.8	94.8	

[Table 2, Figure 2] shows that mean F. nucleatum count (CFU/ml) during undilution in group I was 212.4 and in group II was 291.5, at 1:10 was 125.5 in group I and 217.2 in group II, at 1:50 was 68.2 in group I and 150.3 in group II, at 1:100 was 17.8 in group I and 94.8 in group II. The difference was significant (P< 0.05).

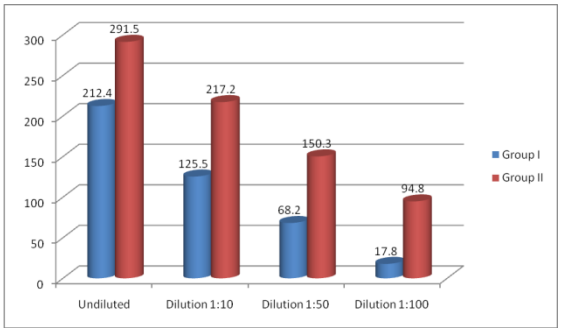

Figure 2: Bactericidal effect of Galium Arsenic (Ga-As) laser on F. nucleatum

DISCUSSION

PDT is based on the principle that a photoactivable substance, the photosensitizer binds to the target cell and can be activated by light of suitable wavelength.[6] During this process, free radicals are formed (singlet oxygen) which then produce an effect that is toxic to the cell. PDT involves the use of low-power laser light with appropriate wavelength to kill cells or microbes previously treated with photosensitizer.[7] The present study was conducted determine bactericidal effect of GaAIAs laser on anaerobic photosensitized periodontopathics.

In this study, we included 120 subjects. Group I contained chronic periodontitis patients (60) and group II were healthy (control) (60). The photosensitizer interacts with the outer wall at the surface of several types of bacteria to increase their permeability and allows a significant amount of photosensitizer to accumulate at the level of cytoplasmic membrane. PDT has been used as a means of eradicating periodontopathic bacteria and photosensitizer have been tested in vitro and in vivo in combination with low-power laser to determine their bactericidal effect. A number of studies have shown that not only can this approach be used to kill bacteria but it can also be used to reduce the impact of bacterial virulence factors.[8]

We found that mean P. gingivalis count (CFU/ml) during undilution in group I was 302.4 and in group II was 401.5, at 1:10 was 204.5 in group I and 328.2 in group II, at 1:50 was 115.2 in group I and 276.3 in group II, at 1:100 was 27.8 in group I and 132.8 in group II. The mean F. nucleatum count (CFU/ml) during undilution in group I was 212.4 and in group II was 291.5, at 1:10 was 125.5 in group I and 217.2 in group II, at 1:50 was 68.2 in group I and 150.3 in

group II, at 1:100 was 17.8 in group I and 94.8 in group II. The difference was significant (P< 0.05).

Dodani et al,[9] in their study 50 patients of chronic periodontitis with pockets ≥5 mm depth were selected with equal number of control. For sample analysis of P. intermedia and P. gingivalis, a subgingival plaque was collected from periodontal pockets. They found that study group shows a reduction in colony count of P. intermedia after being exposed to GaAlAs diode laser for 1 minute from 369–229, 134 and 41 which was statistically significant with p value <0.0001.

The nature of laser light also contributes to nonequal killing rate of bacteria; the most important characteristics are its wavelength, power output, exposure time, whether it is delivered continuously or intermittently, and the diameter of beam. The low level of killing achieved by Ga-As laser radiation–TBO dye combination may be partially attributed to the mismatch between the wavelength of light emitted by laser (λ =904 mm) and the absorption maximum (632 mm) of the dye (range 620–660 mm).[10] Environmental factors of importance include pH, color, thermal conductivity of water and organic matter, and density of cell population which might have overshadowed any accompanying photochemical-induced change.

CONCLUSION

Authors found that GaAIAs laser found to be effective in reducing periodontal pathogens.

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