Use of Antimicrobial Photodynamic Therapy as an Adjunct in the Treatment of Peri-Implantitis: A Prospective Study with 24 Months Follow up

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Abstract

Tamil

Introduction: Despite the long-term predictability of Osseointegrated implants, biologic, biomechanical and esthetic complication can occur in a small percentage of cases. With increasing use of dental implants for rehabilitation of missing teeth there is increase in cases of peri-implantitis. Use of photodynamic therapy has showed promising results for management of peri-implantitis.

Materials and methods: Sixteen patients of peri-implantitis were selected and randomly assigned to test or control group. Readings were taken at baseline, 6 weeks, 6 months, and 24 months for Probing Pocket Depth (PPD), and Bleeding on Probing (BOP). Control group patients were treated with periodontal therapy whereas test group patients were given photodynamic therapy additionally.

Result: 64% reduction in PPD was observed in test group whereas BOP and suppuration were absent. Significant reduction in PPD was seen in control group as well. After 24 months test group had average pocket depth of 2 mm and control group 3 mm.

Conclusion: Use of photodynamic therapy added therapeutic benefit to conventional management and should be considered as a part of peri-implantitis management therapy.

Key Words: *Photodynamic therapy, Peri-implantitis, Diode laser.*

Introduction

Patients demand to replace missing teeth with fixed restorations without affecting adjacent teeth is increasing day by day. Introduction of dental implants by Branemark revolutionised dentistry. With more and more use of implants there are increasing reports of cases of peri-implantitis.

Peri implantitis is considered when there is loss of bone around osseointegrated implant [1]. If left untreated it may lead to suppuration, loss of osseointegration and eventually failed impant [2].

Etiology remains bacterial in nature whereas trauma during surgery, smoking, compromised host response can act as co-factors. The red complex bacteria are commonly seen at sites with peri-implantitis [3]. If plaque accumulates on the implant surfaces, the sub-epithelial connective tissue become infiltrated by large number of inflammatory cells and the epithelium appears ulcerated and loosely adherent. When the plaque front continues to migrate apically, the clinical and radiographic signs of tissue destruction are seen.

Management of peri-implantitis is commonly done by conventional periodontal therapy including removal of plaque, calculus and decontamination [4]. The non-surgical treatment of peri implant bacterial infection involves the local removal of plaque deposits with plastic instruments and polishing of all accessible surfaces with pumice, sub-gingival irrigation of all peri implant pockets with a 0.12% Chlorhexidene, systemic antimicrobial therapy and improved patient compliance with oral hygiene until a healthy peri implant site is established.

Decontamination of implant surfaces can be done by several means [5,6]. Cleaning can be done using special curettes, ultrasonic scalers, air-powder abrasive, citric acid, H_2O_2, chlorhexidine digluconate, EDTA and local or systemic antibiotics [7,8]. An increasing number of studies investigate the potential of systemically or topically applied antimicrobial agents for the treatment of peri-implant infections.

Photodynamic Therapy (PDT) using lasers like diode, erbium lasers, and CO_2 can also be used for decontamination due to its bactericidal effects [9].

Photodynamic therapy uses low-level diode laser with photosensitizing compounds. The photosensitizer binds to the target cells and when it is irradiated it produces reactive agents that are toxic to the target cells [10]. Authors have shown that PDT does not harm titanium surface [11].

Materials and Methods

16 subjects ranging in age from 25 to 60 years were selected. Inclusion criteria of at least one implant site with probing depth (PD) ≥ 4 mm, Bleeding on Probing (BOP), and presence of suppuration was used.

The primary objective was to evaluate change in probing depth whereas secondary objective was to check presence or absence of bleeding on probing and suppuration before and after treatment in both the groups. Patients were divided in test group (PDT with periodontal therapy) and control group (only periodontal therapy).

Scaling was carried out with non-metal tip whereas implant debridement was done with carbon-fiber-reinforced plastic curettes. At the end of the procedure test group was given photodynamic therapy additionaly. All the standard protocols for management of peri-implantitis were followed. Patient's ware educated for oral hygiene methods to be used at home in both the groups. Non-compliant patients were excluded from the study.

The treatment of PDT was performed using HELBO diode laser with a wavelength of 670 nm.

The photosensitizer was applied inside the peri-implant pocket left for 60 seconds followed by rinsing, diode laser was used for 1 minute on each surface**.** Oral hygiene instructions were given to all the patients

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Results

Both groups showed reduction in probing depth compared with baseline values at 6 weeks. Test group showed an average probing depth value of 2 mm when compared with control group which showed 3 mm probing depth at 2 years follow-up *(Table 1)*. Bleeding on probing and suppuration presence in test and control group after 6 weeks were 10% and 40% of sites respectively which reduced to 0% and 20% at 24 months *(Table 2)*.

Discussion

Implant therapy has consistently given good results over the period of years. Still there are cases of peri-implantitis reported to clinicians where management plays a vital role in longevity of implants.

Peri implantitis is considered when there is loss of bone around osseointegrated implant [1]. If left untreated it may lead to suppuration, loss of osseointegration and eventually failed impant [2].

Etiology remains bacterial in nature whereas trauma during surgery, smoking, compromised host response can act as co-factors. The red complex bacteria are commonly seen at sites with peri-implantitis [3]. Early implant failures are the result of events that may jeopardize or prevent Osseointegration from occurring and include:

1. Improper preparation of the recipient site, which results in undue hard tissue damage such as necrosis of the bone.
2. Bacterial contamination and extensive inflammation of the wound that may delay healing of the soft and hard tissues.
3. Improper mechanical stability of the implant following its insertion.
4. Premature loading of the implant.

Late failures occur in situations during which osseointegration of a previously stable and properly functioning implant is lost.

Diagnosis of Peri-implant tissue breakdown-To diagnose a compromised implant site, soft tissue measurements using manual or automated probes have been suggested. Careful monitoring of probing depth and clinical attachment level over time seems useful in detecting changes of the peri implant tissue.

- Radiographic procedures to assess peri implant bone level have been shown to be useful.
- Pocket formation, radiographic destruction, suppuration, calculus build up, swelling, colour changes and bleeding on probing have been documented as signs of peri implant disease.
- Mobility has been extensively described to detect early and late failures after loading of the implants with the super structure. However, mobility should only be used as absolute diagnostic information for lack of osseointegration.
- Microbial monitoring is useful in evaluating the peri-implant health condition and the microbial composition of a peri-implantitis site. This information then can potentially be used to determine the etiology of the breakdown and select a specific antibiotic regimen.

Re-osseointegration can be defined as the growth of new bone in direct contact to the previously contaminated implant surface without an intervening band of organized connective tissue. For regeneration of new bone and reosseointegretion to occur the defect must first be debrided and the decontaminated.

Various modalities including conventional periodontal treatment has shown promising results. Addition of photodynamic therapy to conventional periodontal therapy has shown better results when compared to conventional therapy alone [12-16]. It is based on the principal that a photoactivable substance, the photosensitizer binds to the target cells and can be activated by a light of a suitable wavelength. The process produces free radicals which are toxic to the cells. It selectively kills microbes in presence of host cells.

Diode laser is poorly absorbed in water and dental hard tissues, but highly absorbed in hemoglobin and other pigments. It is indicated for cutting and coagulating gingiva and oral mucosa, and for soft tissue curettage or sulcular debridement. Advantages of diode lasers are the smaller size of the units as well as the lower financial costs.

The application of photochemical drug has proved to be a valuable alternative or supplement to various surgical procedure and other treatment modalities of therapy. Photodynamic therapy leads to greater reduction in bone loss.

Its ease of use and less learning curve has pushed photodynamic therapy in to a potential adjunct to conventional therapy. Present study showed long term follow up results of photodynamic therapy indicating its role in management of peri-implantitis. Hence, PDT should be added to conventional therapy as an adjunct for better long term clinical results.

***Table 1**: Probing depth average values in test and control group after 6 weeks, 6 months and 24 months.*

PD	Test	Control
Baseline	5	5
6 weeks	2	3
6 months	2	3
24 months	2	3

***Table 2**: BOP and suppuration values in test and control group after 6 weeks, 6 months and 24 months.*

BOP/suppuration	Test	Control
Baseline	100%	100%
6 weeks	10%	40%
6 months	0%	30%
24 months	0%	20%

Conclusion

Considering the various advantages of the laser irradiation, its use in combination with conventional mechanical treatment or alone has the potential to improve the condition of the peri-implant pockets more than mechanical therapy alone. Based on the limited research so far, diode laser holds promise to debride both the implant surface and soft tissue wall of the pocket.

Hence authors would like to recommend that photodynamic therapy could be considered an effective method for bacterial reduction on implant surfaces. Our study also confirms its effectiveness in reducing clinical indices and long-term stability of results.

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