A split-mouth longitudinal study comparing the efficacy of photodynamic therapy and ozone therapy in the treatment of chronic periodontitis without the use of surgical procedures.

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Abstract

Background:

A split-mouth longitudinal study was conducted out in order to compare and evaluate the efficacy of mechanical debridement and photodynamic therapy (PDT) in the nonsurgical management of chronic periodontitis. Materials and methods In all, 22 people with a confirmed diagnosis of chronic generalised periodontitis participated in the research. After determining each patient's gingival index, periodontal pocket depth, and clinical attachment loss, a complete mouth cleaning and root planing was performed on each individual. The top right and left quadrants of the bodies of each subject served as sample locations for the investigation. In order to treat these split-mouth sites, ozonated water irrigation was performed on the upper right quadrant of each patient using a 22-gauge needle, and photodynamic therapy (PDT) was performed on the upper left quadrant of each patient. PDT involved the irrigation of the sulcus with indocyanine green dye (0.05 mg/ml), followed by the application of low-level diode laser light at 0.5 W and 810 nm (AMD Picasso) through Clinical indicators that were recorded before the research were reevaluated at the end of the second and sixth months of the study, respectively.

Results:

Both of the research groups' gingival index scores dropped by a level that was statistically significant at each step of the experiment (P 0.05). There were statistically significant variations in the total periodontal pocket depth values in the Ozone therapy (OT) group between the baseline and the second month (P = 0.000), the baseline and the sixth month (P = 0.000), and between the second month and the sixth month (P = 0.029). In contrast, in the PDT group, a statistically significant difference in total periodontal pocket probing depth values was seen between baseline and the second

eISSN 1303-5150

month (P = 0.000) and baseline to the sixth month (P = 0.000), but not between the second month and the sixth month (P = 0.269). This was observed between baseline and the second month (P = 0.000) and between baseline and the sixth month (P = 0.000). There was a statistically significant difference for the total clinical attachment loss in the group OT between the baseline and the second month (P = 0.000), the baseline and the sixth month (P = 0.000), and the second month and the sixth month (P = 0.019). In the PDT group, improvements were found at intervals between baseline and 2 months (P = 0.000) and baseline and 6 months (P = 0.000), but not between the second and sixth months (P = 0.129). These findings were significant.

Conclusion:

The outcomes of the study revealed that mechanical debridement was performed at the end of the first two months of therapy, and was then followed by sub-gingival OT and PDT, both of which considerably enhanced the clinical results of therapy. [Citation needed] [Citation needed] After that, it was revealed that it had improved continuously during the length of the trial, with the outcomes being somewhat better with OT than with PDT.

Treatment options other than surgery, ozone therapy, and photodynamic therapy are discussed, along with persistent periodontitis.

DOI Number: 10.14704/nq.2022.20.11.NQ66104 **NeuroQuantology 2022; 20(11): 1089-1097**

INTRODUCTION

Periodontal health is achieved by the practise of performing routine maintenance on the gingival sulcus and the related tissue architecture. Because of this, a constant maintenance treatment programme that is developed particularly for each patient is required, and this is especially true for patients who have gingival sulcus that is deeper. It is common for people to lack access to even the most fundamental oral hygiene practises, which contributes to the difficulties of attaining an environment that is fully free of plaque. Mechanical debridement and the adjunctive use of chemotherapeutic agents have always been the standard practise in periodontal therapy. [1] The use of numerous such antimicrobial agents led to the development of bacterial antimicrobial resistance, induced undesirable interactions with other drugs to cause adverse effects, and even elicited hypersensitivity in the host. As a direct consequence of this, the consumption of medications of this kind was limited to particular scenarios in which their usage was seen to be essential. As a consequence of this, in addition to the conventional scaling and root planing operations, an alternative usage of numerous additional adjuvant therapies that employ a lower total dose of chemotherapeutic medications has emerged (SRP).

It is now generally accepted that the noninvasive therapies photodynamic therapy (PDT) and ozonated water therapy (OT) are two viable approaches for improving plaque management. PDT and OT both use ozone to treat plaque. In the presence of oxygen, a photosensitizer chemical such as indocyanine green (ICG) combines with laser light of the appropriate wavelength to form free radicals and singlet oxygen, which then damage the DNA and cytoplasmic membrane of the pathogen. The positive effects of photodynamic therapy (PDT) using low-level laser irradiation have been demonstrated in a number of clinical investigations .[2]

Ozone treatment is an effective way for treating periodontitis because of its unique characteristics, including noninvasiveness, flexibility, low side effects, and unfavourable reactions, and exceptional properties. Ozone therapy not only has antimicrobial, analgesic, immunostimulatory, immune-modulatory, and anti-inflammatory effects, but it also oxygenates tissues, raises their functional activity, and enhances their capacity for regeneration. In addition to these benefits,

eISSN 1303-5150

ozone therapy also increases their capacity for regeneration. [7] It has been demonstrated that drinking ozonated water with a concentration of 0.5-4 mg/L greatly cuts down on the production of dental plaque. [8] Additionally, it has been proven to be an effective antibacterial agent for subgingival irrigation in individuals who suffer from chronic periodontitis .[9]

These two approaches have only been the subject of research, which has shown that they are successful as nonsurgical therapy for the treatment of periodontitis. There has not been a lot of research done to determine whether or not these two approaches are effective when applied on top of the typical plaque-control regimen. The purpose of the current split-mouth trial, which is the first study of its kind, is to determine whether or not OT can guarantee a clinical outcome that is close to or comparable to that produced by the complex and pricey PDT in the treatment of chronic periodontitis that does not involve surgery.

The purpose of this research was to determine whether or not OT and PDT, when used in conjunction with mechanical debridement, have a therapeutic benefit in the treatment of chronic periodontitis that does not include surgery. The objectives of the study were to evaluate and compare the periodontal status of patients after using OT and PDT once, along with traditional mechanical debridement, in the management of chronic periodontitis at the end of two months, and to evaluate and compare the periodontal status of patients in the OT and PDT groups after six months after using their respective therapies exclusively twice a month, repeatedly, without mechanical debridement, in the management of chronic periodontitis. The traditional mechanical debridement was used

METHOD AND MATERIALS

The selection of study participants was carried out in a manner that adhered to the principles outlined in the Declaration of Helsinki, which governs the conduct of clinical studies involving human participants. Everyone who took part in the research project gave their written approval after being informed. In order to conduct the statistical analysis, the 19th edition of IBM SPSS Statistics for Windows was utilised (IBM Corp., Armonk, N.Y., USA). Patients with chronic generalised periodontitis who had at least 4-5 locations with periodontal pockets ranging in depth from 3 mm to 10 mm in both the right and left maxillary quadrants participated in the study. The depth of the periodontal pockets varied from 3 mm to 10 mm. The number of patients in the sample was set at 22, and both of their upper arches were evaluated as part of the split-mouth examination. The level of significance was set at 0.05 for the probability level, while the level of confidence was set at 95%.

Patients between the ages of 45 and 70 who satisfied the following sample selection criteria were chosen for the study: entire dentition up to and including the second molar teeth was present in each upper quadrant of each patient's mouth. Patients who displayed detrimental behaviours that persisted over the course of the investigation as well as those who had taken any antimicrobial medicine in the preceding three months were not included. During the initial visit, a comprehensive case history of each patient was obtained in order to classify the samples as chronic periodontitis patients in accordance with the American Academy of Periodontology's classification of periodontal diseases and conditions,[10] by evaluating the patient's periodontal health using the gingival index,[11] periodontal pocket probing depth, and clinical attachment level scorings. The patients were also informed about the study and provided with written consent forms. During the length of the double-blind trial, only one examiner was

eISSN 1303-5150

responsible for evaluating and recording any of the research's parameters.

All of the patients were given appointments for their specific treatments at the earliest available opportunity during the next two weeks. At each of the two sample locations, the gingival index score, periodontal pocket depth, and clinical attachment loss in each of the upper arches' two quadrants were assessed. After adding together all of these ratings, a total score was calculated for each parameter at each unique site. This total score will be used in the future to make comparisons between the sites.

In every instance, PDT was taken into consideration for one quadrant, while occupational therapy (OT) was allocated to the other quadrant. The right and left quadrants were divided evenly between the two therapies. Whenever we exposed the second study location, we made sure to keep the adjacent quadrants divided using cotton rolls. In every single case, a full mouth comprehensive SRP was performed. After that, the photosensitizer for the PDT procedure, which was an ICG dye, was rinsed in one of the compartments of each case. ICG dye has been utilised as a photosensitizer due to the fact that it possesses excellent qualities. It has a wide optical absorption band that extends from 600 to 810 nm, with the peak absorption occurring between 800 and 810 nm. It has been stated that the ICG dye does not undergo any chemical changes while it is in the body and that it is quickly removed in the bile. A needle with a gauge of 22 was utilised for the injection of the dye, and once it had been completely flushed out, the needle was pushed continually in a horizontal direction along the base of the pocket. At each site, pockets were flushed with the photosensitizer for no more than a minute and a half at the utmost. They were then exposed to low-level laser light using an AMD Picasso diode laser system, which had an intensity of 0.5 W and a wavelength of 810 nm (AMD Lasers, LLC; 7405 Westfield Blvd, Indianapolis, IN, USA). A fiber-optic programme with a core diameter of 400 m, a tip length of 10 mm, and a default inclination of 60° was used to transfer the laser light. In order to ensure that all areas of the pocket were irradiated, the laser beam was guided like an ultrasonic probe from the bottom of the pocket to the gingival margin while making continuous horizontal movements. [16] The photosensitizer was then completely removed by flushing with sterile water and vacuum evacuation. Irradiation settings utilised the conventional suggested approach of 0.5 W for 1 minute in noncontact continuous wave mode [13,14,15,16]. It was recommended to take every effort to maintain isolation in order to prevent the material from contaminating the surrounding quadrants of the same arch. After this, the opposite quadrant was prepared for OT as it should be. The doctor advised the patient to gargle with water from the sink whenever she felt the need.

Oral irrigation with ozonated water was performed in this quadrant using a device specifically designed for subgingival irrigation (Kent Ozone Dental Jet TY-820). In order to standardise the mode of administration as is done with photosensitizers in laser therapy, the irrigation was delivered using a 22-gauge needle that was fastened to the tip of its nozzle. This was done in order to ensure that the method was carried out in the same manner. The sample area was watered for a total of five to ten minutes[9] using a device that generates 0.082 mg/h of ozone in a single, pulsating stream of water. This was done utilising a single stream of water. Overflowing ozonated water was extracted using cotton rollers and high-powered vacuum suction in order to prevent the water from spreading to other study areas.

After two months, each of the 22 patients in the research had their gingival index, total

periodontal pocket probing depth, and total clinical attachment loss measured and analysed separately on both sides of the upper arch. This was done as part of the study. After recording and tabulating the data, the same agents were administered again in the same way in the relevant locations without any mechanical debridement being performed first. Patients were asked to return at the conclusion of the fourth month after the start of the trial so that they may undergo a second round of treatment that did not include any mechanical debridement. At the end of the sixth month after the start of the research, all of the factors under consideration were reevaluated. The scores at various stages during the second, fourth, and sixth months were compiled for comparison and assessment. The scores were obtained at the beginning of the experiment when adequate therapy and mechanical debridement were applied.

RESULTS

Following the administration of each medication, the values of gingival index, periodontal pocket probing depth, and clinical attachment loss of each quadrant of all 22 patients were summed together to get the final score. This was done so that a comparison could be made between the groups. After that, the mean score was calculated in order to facilitate comparison between this result and the other 22 samples. The repeated measures ANOVA was utilised in order to analyse the differences in various clinical parameters that emerged between the groups as a result of the comparison of baseline values to those from the second and sixth months. The threshold for statistical significance was determined to be P less than 0.05. At each time point, a comparison of the values obtained from the two groups was carried out.

In group OT, the mean scores dropped from 1.8041± 0.17 to 1.3395± 0.25 at the end of the second month, and then they dropped to 1.1995 ±0.09 at the end of the sixth month. On the other hand, in group PDT, the mean scores dropped from 1.7618±0.18 to 1.385± 0.17 to 1.2059± 0.11 in the second month. As a consequence of this, there was a discernible rise in gingival index scores over the observation periods of every two months in both groups (P = 0.000), which was found to be statistically significant.

When the gingival index scores of the two groups were compared using the split-mouth method, there was not much of a difference between the two groups. Within both treatment groups, a substantial drop was observed after two months and six months, with the first interval following the evaluation after mechanical debridement exhibiting the highest reduction. This was the case even though both treatment groups received the same therapy. However, this outcome was consistent across the board for all groups at all time periods.

In the total periodontal pocket probing depth assessment in each quadrant, Group OT showed a shift in the mean total pocket depth values of sample sites, going from 2.58 ±0.33 to 2.27 ±0.27 in the second month and then to 2.14 ±0.28 in the sixth month. These changes occurred between the second and sixth months. After two months of treatment with PDT, the mean pocket depth values dropped to 2.31± 0.30, and then they dropped again to 2.24± 0.33 after six months of treatment. These values had previously been 2.8 ±0.28. There was a statistically significant difference in the total periodontal pocket depth values in group OT between the baseline and second month (P = 0.000), the baseline and sixth month (P = 0.000), and the second month and sixth month (P = 0.029). There was a statistically significant difference in the total periodontal pocket probing depth values in the PDT group between the baseline and the second month (P = 0.000) and from the baseline to the sixth month (P = 0.000), but not between the second month and the sixth month (P = 0.269). On the other hand, there was no difference between the second month

eISSN 1303-5150

and the sixth month in the PDT group. When the total periodontal pocket probing depth values of the two groups were examined, there were not many significant differences found.

After the group OT, the mean total clinical attachment loss values went from 2.880 to 2.410in just two months, and then they went from there to 2.260 in another six months. During the time that participants were assigned to the group that received PDT, the mean total clinical attachment loss values experienced a decrease from 2.45 to 0.31 to 2.97 in the first two months, before experiencing a further reduction to 2.37 in the sixth month. There was a statistically significant difference for the total clinical attachment loss in the group OT between the baseline and the second month (P = 0.000), the baseline and the sixth month (P = 0.000), and the second month and the sixth month (P = 0.019). In the PDT group, improvements were found at intervals between baseline and 2 months (P = 0.000) and baseline and 6 months (P = 0.000), but not between the second and sixth months (P = 0.129). These findings were significant.

In contrast to the findings of the investigations of probing depth and gingival index, the results of the comparison of total clinical attachment loss values between the OT and PDT groups did not reveal any variations. In terms of the clinical attachment gain, there was a significant increase at the two-month and six-month marks in both of the treatment groups. On the other hand, there was a greater decrease at the conclusion of the second month, which occurred just after the mechanical debridement and the appropriate therapy.

DISCUSSION

PDT and ozone therapy are two antimicrobial therapeutic approaches that have been evaluated and shown to be effective in order to accomplish nonsurgical periodontal therapy in persons who have chronic periodontitis. However, there was very little research that compared the effectiveness of these two treatments that was published in the relevant academic journals. The present study found that clinical measures like as gingival index, total periodontal pocket score, and total clinical attachment loss favoured both operations practically equally and showed excellent clinical advantages. Additionally, the study found that both procedures exhibited remarkable clinical benefits.

An in vitro study conducted by Huth et al. to investigate the antimicrobial potential of ozone in comparison with chlorhexidine gluconate revealed that there was no significant difference in the effectiveness of aqueous or gaseous ozone compared to that of 2% chlorhexidine gluconate. [18] Observations from a randomised controlled clinical trial revealed significant reductions in the number of putative periodontopathic microorganisms when exposed to gaseous In a randomised controlled trial conducted by Hayakumo et al. using ozone nanobubble-water therapy, periodontal pocket depth reduction and attachment gain were achieved at 4-week and 8-week intervals, respectively.[20] Results from microbiological assessment also support the use of ozone as an effective adjuvant in managing moderate-to-severe chronic periodontitis.[21] Yilmaz et alinvestigationssuggested .'s that gaseous .[22] In a variety of clinical trials, photodynamic therapy (PDT) and mechanical debridement have been performed, and these studies have revealed various levels of effectiveness. Few research [4,5,23] indicated a major improvement in clinical parameters when PDT was used as an addition to SRP compared to SRP alone. On the other hand, a few studies [14,24,25] revealed that utilising PDT as an adjunct did not provide any significant advantages. In the current study, it was found that there was a statistically significant difference between the clinical parameters that were obtained at baseline before the administration of PDT and those that were obtained at intervals of 2 months and 6 months after the study. This difference was

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found between the clinical parameters that were acquired at intervals of 2 months and 6 months after the study. When PDT was utilised on its own without repeating the SRP, such substantial variations in total periodontal pocket depth and attachment gain were not seen between the observations documented after 2 months and those seen after 6 months of the trial. This was the case when comparing the results of the trial after 2 months and those seen after 6 months. Despite the abundance of promising studies on the advantages of its application, there is still a great deal of controversy over the actual benefits that PDT may bring to the treatment of periodontal disease.

In this study, for the very first time of its kind, an investigation of the long-term clinical effects of PDT and OT when performed repeatedly without mechanical debridement other than for the initial time in the nonsurgical therapy of chronic periodontitis was carried out. Specifically, the investigation focused on the long-term clinical effects of PDT and OT when performed repeatedly without mechanical debridement other than for the initial time. None of the study that has been carried out up to this point has taken into consideration contrasting the efficacy of these two methods when they are utilised often and in a manner that splits the mouth. In order to evaluate the potential efficacy of OT and PDT as an adjuvant to nonsurgical management of chronic periodontitis in typical clinical settings, a more advanced research design with an increased number of biochemical and microbiological assays as well as a longer duration is required.

CONCLUSION

Although ozone therapy had somewhat superior clinical results, the current study's observations showed no statistically significant difference in clinical parameters between OT and PDT when tested after 2 months, 4 months, and 6 months. This was the case even though OT had somewhat superior clinical results. The fact that clinical parameters improved throughout the course of this trial lends credence to the theory that PDT and OT, when administered regularly and at regular intervals, have a beneficial effect on patients who require it. Aside from the constraints imposed by the study itself, it is acceptable to derive the conclusion that ozone therapy and pulsed-dye laser therapy (PDT) are both effective nonsurgical therapies for chronic periodontitis; however, OT consistently outperforms PDT throughout the treatment process.

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