Review Article

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Low Level Laser Therapy in Diabetes: A Review

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ABSTRACT

Background: Diabetes mellitus (DM) increases the risk of periodontitis, and severe periodontitis often coexists with severe DM. The proposed dual pathway of tissue destruction suggests that control of chronic periodontal infection and gingival inflammation is essential for achieving long-term control of DM. The purpose this review is to evaluate the effects of low-level laser therapy (LLLT) in patients with DM and gingival inflammation.

Keywords: Low level laser therapy Diabetes mellitus, Periodontal and gingival inflammation.

INTRODUCTION

Diabetes mellitus (DM) is a chronic metabolic disorder caused by inherited or acquired deficiency in production of insulin by the pancreas or by the ineffectiveness of the insulin produced. The high level of glucose present in the blood has profound effects on various systems of the human body.1 Periodontitis is a chronic infectious disease of the supporting tissues around the teeth leading to its progressive destruction. DM increases the risk of periodontitis, and severe periodontitis with pronounced gingival inflammation often coexists with severe DM.2,3 Low-level laser therapy (LLLT) was introduced as a therapeutic modality as early as 1968.4 LLLT has shown to be effective in the treatment of impaired microcirculation, wound healing,5,6 pain relief,7-9 fracture healing, and reduction of inflammation and swelling.10,11 It is widely accepted today that the inflammation is a basic response of periodontal tissue to damage and serves as a fast first line of defense. Investigators have suggested that LLLT reduces gingival inflammation and that better therapeutic results were achieved when LLLT was applied during basic periodontal therapy compared with applying basic periodontal therapy alone.12 Until now, there has been little knowledge pertaining to a study of LLLT in periodontal disease in patients with DM. Gingival inflammation in periodontal disease is common in patients with DM. Depending on the degree of differentiation, epithelium cells show variations in size and shape. Also, enlargement of cell nuclear area and decrease of keratinization are noticed.18 Morphometric analysis of inflamed gingival tissue can suggest changes in the periodontium and whole body that are manifested in the superficial gingival epithelium.24 So, LLLT can be used as an adjunct to conventional therapies for the treatment of periodontal inflammation in patients with DM. This review gives an overview of how LLLT is beneficial in DM patients.

DISCUSSION

Diabetes mellitus (DM) is a chronic metabolic disorder caused by inherited or acquired deficiency in production of insulin by the pancreas or by the ineffectiveness of the insulin produced.

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The high level of glucose present in the blood has profound effects on various systems of the human body.1 Periodontitis is a chronic infectious disease of the supporting tissues around the teeth leading to its progressive destruction. DM increases the risk of periodontitis, and severe periodontitis with pronounced gingival inflammation often coexists with severe DM.2,3 It is suggested that hyperglycemia could indirectly exacerbate inflammatory tissue destruction through the body's scavenger system against advanced glycation end-products and that hyperglycemia might directly impair the biological functions of periodontal connective tissues through cell–matrix interactions.13 Also severe periodontitis increases the severity of DM and complicates metabolic control.

The impact of periodontal disease on glycemic control of DM and the mechanisms through which this occurs is less clear. It is suggested that an infection-mediated regulation cycle of cytokine synthesis and secretion by chronic stimulus from lipopolysaccharide and products of periodontopathogenic organisms may amplify the magnitude of the advanced glycation end-product–mediated cytokine response operative in DM. The proposed dual pathway of tissue destruction suggests that control of chronic periodontal infection and gingival inflammation is essential for achieving long-term control of DM.2

Early diagnosis of gingivitis that occurs during periodontitis initiation and progression and its treatment are of the most importance to avoid progression of the disease and complications.14 The relationship between these periodontitis events and DM appears bidirectional. The presence of one condition tends to promote the other, and the meticulous management of either may assist treatment of the other. Investigators have suggested that control of gingival inflammation during chronic periodontal infection is essential for achieving long-term control of DM and that all patients with DM should be encouraged to regularly visit a periodontist in order to maintain a high level of oral and periodontal health.2

Conventional therapies result in wounding of the already inflamed periodontal tissues, the consequence of such therapeutic procedures depends largely on the cellular and molecular events associated with wound healing. In the last decade, applying lasers as an adjunctive or alternative to current mechanical treatment had a great run in the treatment of gingival inflammation.15,16 Among laser applications, low-level laser therapy (LLLT) is recommended for its pain-reducing, wound- healing promoter and anti-inflammatory effects. Low-level laser therapy (LLLT) was introduced as a therapeutic modality as early as 1968.4

It is suggested that LLLT alters cellular behavior by affecting the mitochondrial respiratory chain or membrane calcium channels, and that it can facilitate collagen synthesis, angiogenesis, and growth factor release, which eventually accelerate wound healing.

A literature review revealed several studies that have found an improvement in periodontal wound healing with the use of LLLT, both in vitro and in vivo.17-21 After scaling and root planing, adjuvant LLLT was shown to significantly reduce gingivitis, probing depth, and gingival crevicular fluid volume.17 LLLT has been observed to produce an anti- inflammatory effect, a biostimulatory effect, and an analgesic effect. The anti-inflammatory effect and edema reduction can partially be explained by the normalized homeostasis in tissue metabolism and inhibition of mast cell degranulation.14Studies of the use of the low-level laser vary with regard to the types of laser and parameters of laser radiation,22 but the clinical benefits observed when lasers are used are beyond doubt.14Houreld and Abrahamse4 showed that wounded cells in patients with DM respond in a dose- and a wave- length-dependent manner to laser light, and the best results can be achieved on irradiation with a dose of 5J/cm2 at a wavelength of 632.8 nm.

Obradović et al[23] treated patients with diabetes mellitus and periodontal disease by use of LLLT (670 nm, 5 mW, 2 J/cm2, 16 minutes for five days) together with conventional periodontal treatment and concluded that healing was improved as well as collagenization and homogenization in gingival lamina propria on the basis of histopathological findings.

Gingival inflammation is common in periodontitis, especially in diabetes patients.

Regardless of the degree of differentiation, epithelial cells demonstrate deviations in size and shape. Cytomorphological assays enable the association between structure and function of certain types of tissue and a better understanding of the reactions of the affected organism as manifested in the superficial gingival epithelium. It is known that the nuclei of the squamous stratified epithelium enlarge during gingival inflammatory reactions in periodontitis.14 Inflammation is one of the factors that can increase nuclear area and lead to a poorly preserved cytoplasm.24

Igic et al.,14 who conducted a pioneering attempt to demonstrate the events in the gingival cells during inflammation, as well as the changes occurring after LLLT treatment in children. They confirmed that gingivitis can be successfully treated with LLLT as a supplement to basic treatment. Cytomorphometric analysis confirmed that the nuclei of the squamous stratified gingival epithelium were reduced in size after basic treatment, although not to the size of the nuclei of healthy gingiva. However, after LLLT in addition to basic treatment of gingivitis, the nuclear size of the cells of the squamous stratified gingival epithelium corresponded to the size characteristic of healthy gingiva

The general opinion is that patients with DM exhibit poorer periodontal health and poorer therapeutic response than patients without DM.25

It is suggested that control of gingivitis during periodontal infection is important for achieving long- term control of DM.2 Therefore, a periodontist should be consulted in the treatment of periodontal patients with DM in aim to achieve better and longer-lasting therapeutic results.26

CONCLUSION

It can be concluded that LLLT as an adjunct in periodontal therapy reduces gingival inflammation in patients with DM and periodontitis Close collaboration among the patient, primary healthcare professionals, and oral health professionals and further investigation of new therapeutic modalities such as LLLT could be a way of improving the general and periodontal health in patients with DM.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

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