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Review

SYSTEMIC EVALUATION AND GOOD PRACTICE OF THE SURGICAL PATIENT WITH CARDIOVASCULAR DISEASE: NARRATIVE REVIEW

I. Catalano[1*§], C. Annicchiarico[1§], A. Annicchiarico[2] and A. Coppola[3]

[1] Department of Clinical and Experimental Medicine, University of Foggia, Foggia, Italy;
[2] University of Bari "A. Moro", Bari, Italy;
[3] Independent Researcher, Naples, Italy.

**Correspondence to*:
Irene Catalano,
Department of Clinical and Experimental Medicine,
University of Foggia,
71122 Foggia, Italy.
e-mail: irecata@icluod.com

§ Equal contribution

ABSTRACT

Objective: The objective of the study was to evaluate the correct management of dental patients undergoing oral surgery, suffering from cardiovascular disease. *Methods:* Research and analysis was carried out of systemic reviews in the English language that were about the application of artificial intelligence in dental fields, using databases such as Web of Science, Scopus, and PubMed. *Results:* Based on the results of the study, we can conclude that the 980 nm diode laser is a useful tool in the treatment of periodontitis in post-myocardial infarction patients, as it is painless, eliminates the risk of bleeding, reduces the need for anaesthesia and causes accelerated tissue healing. It also proves to be a valid therapeutic alternative, as it prevents cardiac overload due to the adrenergic reaction induced by dental surgery, which can trigger acute ischemic events. *Conclusions:* The use of the 980 nm (1 W, continuous wave) diode laser in patients with post-myocardial infarction periodontitis helps to reduce the depth of the periodontal pockets (7 mm) and lowers the bacterial load, delaying recolonization during a 3-month observation period. It has no significant effect on bleeding at the probe (BOP), clinical attack level (CAL) or plaque control index (PCR), nor does it significantly reduce pathogens related to cardiovascular disease. However, as it is painless, reduces bleeding and accelerates healing without the need for anaesthesia, laser represents a valid and less invasive therapeutic alternative, reducing cardiac stress and the risk of ischemic events.

KEYWORDS: *Oral health, oral surgery, cardiovascular disease, laser, dental disease, heart disease*

INTRODUCTION

Cardiovascular diseases, which include ischemic heart disease (such as acute myocardial infarction and angina pectoris) and cerebrovascular disease (such as ischemic and hemorrhagic stroke), are the main causes of morbidity, disability and mortality in Italy (1). Although many of these conditions are preventable, non-modifiable risk factors such as age, sex and familiarity are associated with modifiable lifestyle and behavioral factors such as smoking, alcohol, poor diet and sedentary behavior, which in turn promote the development of diabetes, obesity, hypercholesterolemia and high blood pressure. Patients with cardiovascular disease who report to the dentist can be distinguished by primary pathology,

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which may include arrhythmias, heart failure, ischemic heart disease, high blood pressure and those who have undergone cardiac surgery (2). The dental management of these patients requires a personalized approach, considering the cardiovascular condition and related risks associated with dental operations (3).

Cardiovascular diseases in Italy affect a significant number of people, with a prevalence of about 2%, rising to 6-9% in the most advanced age groups (70-79 years and 80-89 years). In the last 15-20 years, prevalence has increased, leading to an increase in annual expenses for the National Health Service. Heart failure is a condition in which the heart cannot contract or relax properly, preventing proper blood circulation (4). This leads to reduced organ perfusion and fluid accumulation, causing edema and difficulty breathing. Diseases that develop into heart failure include ischemic cardiomyopathy, high blood pressure and valvular disease. The symptomatology varies depending on whether the failure concerns the right or left side of the heart, with signs such as edema in the lower limbs, turgor of the jugular and ascites, in the case of right cardiac insufficiency, and dyspnea and ortopnea for the left (4). When the disease progresses, congestive heart failure develops, characterized by venous stasis and reduced peripheral perfusion.

Ischemic heart disease, which affects about 2.5-4% of the Italian population, is caused by an insufficient supply of blood and oxygen to the heart muscle. The main causes are atherosclerosis and coronary spasms, which reduce blood flow in coronary arteries (5). Ischemic heart disease can manifest itself in the form of angina pectoris, which presents as a retrosternal chest pain radiating to the left arm, precipitating during stress or physical activity. Angina occurs when the heart does not receive enough oxygen due to a narrowing of the coronary arteries. This condition can be further worsened by stress situations, such as those induced by oral surgery, which increase cardiac demand and may trigger acute seizures.

Myocardial infarction is the necrosis of a part of the heart muscle caused by the obstruction of a coronary artery, with common symptoms such as chest pain, cold sweating, malaise, nausea and vomiting. The pain, which may radiate to the neck, jaw, arms and back, initially occurs for short periods and can develop into angina pectoris (4). The latter, a transient ischemia, is a sign of a potential future heart attack.

Arterial hypertension, which affects one third of the population, is characterized by blood pressure above 140/90 mmHg. The pathology can lead to serious complications such as hypertensive heart disease, nephropathy and chronic encephalopathy. Dental or surgical procedures can cause high blood pressure peaks, increasing the risk of hypertensive crisis or heart attack (5). Antihypertensive drugs can also cause side effects such as hypotension and syncope.

Arrhythmias, which affect between 10% and 17% of the population, are alterations in the heart rhythm that can be caused by problems of conduction of the heart. They can manifest as tachycardia, bradycardia or extrasystole and are an important risk factor during surgical dental procedures. Arrhythmias can be classified into hyperkinetic (tachycardia), hypokinetic (bradycardia) and ectopic (extrasystole).

Finally, patients undergoing cardiac surgery, such as heart valve replacement or coronary bypass, require careful dental management because these procedures affect their cardiovascular condition (6). Cardiac surgery also includes operations for aneurysms, aortic dissections and pacemaker implantation. The dental management of these patients must consider the risk of complications related to their cardiovascular condition and treatments received (7).

The formulation of an adequate diagnostic and therapeutic plan is based on a proper perioperative risk assessment, which includes both medical and surgical risks (7). The medical risk assessment takes into account factors such as the patient's age, systemic diseases and existing pharmacological or surgical therapies. The patient's disease can be classified into three stages of medical risk: low, medium and high. The surgical risk assessment, on the other hand, considers the operating environment, the anesthesia and the anatomical district involved in the operation. Non-surgical therapies are divided into non-invasive, simple or extended, with a surgical risk generally absent or reduced. Surgical therapies are classified as simple, complex and extensive, with a surgical risk that can be reduced, moderate or high. The American Society of Anesthesiologists has also created a classification to assess the patient's physical state in relation to anesthetic risk, which must be considered in close correlation with surgical risk (8,9).

The assessment of cardiac patients before, during and after non-cardiac surgery is crucial to avoid cardiovascular complications. Patients at risk include those with myocardial ischemia, valvopathies, heart failure, arrhythmias and other heart conditions. Surgery and postoperative pain can increase the heart's oxygen demand, causing ischemia and other complications (10). Risk assessment is based on the patient's condition and the planned intervention, using diagnostic tests such as echocardiograms, stress tests and biomarkers. Pre- and post-operative drugs, such as beta-blockers and ACE inhibitors, may reduce the risk. In addition, the use of NSAIDs in cardiac patients should be limited as it can cause serious side effects. Every year in Europe, about 5.9 million non-cardiac operations are performed on heart patients, with a perioperative mortality ranging from 0.8% to 1.5%. The risk of heart complications, such as heart attack or arrhythmia, increases depending on the type of surgery (10-12).

Antibiotic prophylaxis in oral surgery prevents endocardial infections caused by transient bacteriaemia during surgeries. Amoxicillin is administered one hour before surgery and, if necessary, six hours later. For penicillin allergies,

clindamycin, cephalexin or azithromycin are used. For patients with heart disease, nitroglycerin may be used to prevent ischemic events. In patients with Prinzmetal angina, therapy with calcium antagonists is maintained. Aspirin can be stopped before surgery only if hemostasis is difficult to control. The management of cardiovascular risk varies according to the patient: with reduced risk trinitrin is recommended, while for moderate and high risk, premedication with sedation, oxygen and trinitrin is necessary (8,13).

The laser was introduced to dentistry in the 1970s and has since been used for treatments of oral diseases, including dental and soft tissue interventions such as periodontitis, endodontics and aesthetic dentistry. The lasers used include solid-state (Nd :YAG, Er :YAG), gas (CO2) and semiconductor (diode) lasers. An important advantage of the laser in dentistry is the reduction of bleeding, especially useful for patients with heart or coagulopathies, reducing the need for pre- and post-operative pharmacological prophylaxis (9,14,15).

A clinical study conducted in 2019 evaluated the effectiveness of 980 nm diode laser in the treatment of periodontitis in patients after myocardial infarction. The study involved 36 patients with periodontitis, who were divided into two groups: one treated with scaling and root planing (SRP) and the other with SRP followed by laser therapy. The laser-treated group showed a significant reduction of deep periodontal pockets (PPD 7 mm) and a reduction in bacteria, without adverse effects. After 3 months of treatment, both groups showed a significant reduction in bleeding at the probe (BOP) and plaque control index (PCR), but there were no statistically significant differences between the groups. However, in the laser-treated group, a higher percentage of deep pockets was reduced to less deep pockets, indicating clinical improvement compared with the control group. In summary, laser treatment added to SRP has shown a potential benefit in the treatment of periodontitis in post-infarction patients by reducing deep pockets and improving the effectiveness of treatment (9,16).

DISCUSSION

The additional use of the 980 nm (1 W, continuous wave) diode laser has led to a significant reduction in the depth of periodontal pockets above 7 mm, allowing patients to avoid surgical treatments after a myocardial infarction. No effects were observed in the lower depth periodontal pockets. The laser treatment reduced the total number of bacteria and delayed recolonization during the 3-month observation period. However, the additional use of diode laser after radicular sanding (SRP) had no significant effects on BOP, clinical attack level (CAL) or PCR.

In addition, the use of diode laser has not further reduced levels of Porphyromonas gingivalis, Treponema denticola and Tannerella forsythia, key pathogens linking periodontitis and cardiovascular disease. In the control group, a significant increase in the number of Capnocytophaga gingivalis was observed.

Based on the results of the study, we can conclude that the 980nm diode laser is a useful tool in the treatment of periodontitis in post-myocardial infarction patients, as it is painless, eliminates the risk of bleeding, reduces the need for anaesthesia and causes accelerated tissue healing. It also proves to be a valid therapeutic alternative, as it prevents cardiac overload due to the adrenergic reaction induced by dental surgery, which can trigger acute ischemic events (17).

CONCLUSIONS

The additional use of 980 nm, 1 W, CW laser allows a significant reduction in pocket depth 7 mm, which allows the patient to avoid surgical treatment after myocardial infarction; no effect has been seen in lower pockets. The diode laser reduces the total number of bacteria and delays recolonization during a 3-month observation period. The additional use of a diode laser after SRP has no significant effect on BOP, CAL and PCR. Additional use of a diode laser in patients with periodontitis and after myocardial infarction does not further reduce the levels of Porfiromonas gingivalis, Treponema denticola and Tannerella forsythia, which are key pathogens that link periodontitis and cardiovascular disease. In the control group, a significant increase in the number of Capnocytophaga gingivalis bacteria was observed. Within the limits of our study, we can conclude that the 980nm diode laser may be a useful tool in the treatment of periodontitis in patients after myocardial infarction because: it is not painful , eliminates the risk of bleeding , often there is no need for anaesthesia , determines an accelerated healing of tissues and therefore proves to be a valid therapeutic alternative since it prevents the cardiac overload caused by adrenergic reaction following dental surgery (stress, anxiety and pain) may trigger acute ischemic heart disease.

In general, cardiovascular disease is an important cause of morbidity and mortality, and its proper management, even in dental settings, is essential to avoid acute complications.

Conflict of interest

The authors declare that they have no conflict of interest.

REFERENCES

1. Chobanian AV, Bakris GL, Black HR, et al. Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure. *Hypertension*. 2003;42(6):1206-1252. doi:https://doi.org/10.1161/01.hyp.0000107251.49515.c2
2. Kristensen SD, Knuuti J, Saraste A, et al. 2014 ESC/ESA Guidelines on non-cardiac surgery: cardiovascular assessment and management: The Joint Task Force on non-cardiac surgery: cardiovascular assessment and management of the European Society of Cardiology (ESC) and the European Society of Anaesthesiology (ESA). *Eur Heart J*. 2014;35(35):2383-2431. doi:https://doi.org/10.1093/eurheartj/ehu282
3. Niwa H, Sugimura M, Satoh Y, Tanimoto A. Cardiovascular response to epinephrine-containing local anesthesia in patients with cardiovascular disease. *Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontology*. 2001;92(6):610-616. doi:https://doi.org/10.1067/moe.2001.118903
4. Neves RS, Neves ILI, Giorgi DMA, et al. Effects of epinephrine in local dental anesthesia in patients with coronary artery disease. *Arquivos Brasileiros De Cardiologia*. 2007;88(5):545-551. doi:https://doi.org/10.1590/s0066-782x2007000500008
5. Guimaraes CC, Lopes LC, Bergamaschi C de C, et al. Local anaesthetics combined with vasoconstrictors in patients with cardiovascular disease undergoing dental procedures: systematic review and meta-analysis. *BMJ Open*. 2021;11(7):e044357. doi:https://doi.org/10.1136/bmjopen-2020-044357
6. Becker DE, Reed KL. Local Anesthetics: Review of Pharmacological Considerations. *Anesthesia Progress*. 2012;59(2):90-102. doi:https://doi.org/10.2344/0003-3006-59.2.90
7. Lu P, Gong Y, Chen Y, Cai W, Sheng J. Safety analysis of tooth extraction in elderly patients with cardiovascular diseases. *Medical Science Monitor : International Medical Journal of Experimental and Clinical Research*. 2014;20:782-788. doi:https://doi.org/10.12659/MSM.890131
8. Håheim LL, Olsen I, Rønningen KS. Association between tooth extraction due to infection and myocardial infarction. *Community Dentistry and Oral Epidemiology*. 2011;39(5):393-397. doi:https://doi.org/10.1111/j.1600-0528.2011.00616.x
9. Tettamanti L, Kritas SK, Gallenga CE, et al. IL-33 mediates allergy through mast cell activation: Potential inhibitory effect of certain cytokines. *J Biol Regul Homeost Agents*. 2018;32(5):1061-1065.
10. Muzio LL, Stefano Tetè, Mastrangelo F, et al. A novel mutation of gene CBFA1/RUNX2 in cleidocranial dysplasia. *PubMed*. 2007;37(2):115-120.
11. Conti P, Caraffa A, Ronconi G, et al. Impact of mast cells in mucosal immunity of intestinal inflammation: Inhibitory effect of IL-37. *European Journal of Pharmacology*. 2018;818:294-299. doi:https://doi.org/10.1016/j.ejphar.2017.09.044
12. Tranasi M, Sberna MT, Zizzari V, et al. Microarray Evaluation of Age-related Changes in Human Dental Pulp. *Journal of Endodontics*. 2009;35(9):1211-1217. doi:https://doi.org/10.1016/j.joen.2009.05.026
13. Lauritano D, Mastrangelo F, D'Ovidio C, et al. Activation of Mast Cells by Neuropeptides: The Role of Pro-Inflammatory and Anti-Inflammatory Cytokines. *International Journal of Molecular Sciences*. 2023;24(5):4811. doi:https://doi.org/10.3390/ijms24054811
14. Carinci F, Arcelli D, Lo Muzio L, et al. Molecular classification of nodal metastasis in primary larynx squamous cell carcinoma. *Translational Research*. 2007;150(4):233-245. doi:https://doi.org/10.1016/j.trsl.2007.03.011
15. Mastrangelo F, Dedola A, Cattoni F, et al. Etiological periodontal treatment with and without low-level laser therapy on IL-1β level in gingival crevicular fluid: an in vivo multicentric pilot study. *J Biol Regul Homeost Agents*. 2018;32(2):425-431.
16. Minetti E, Palermo A, Ferrante F, et al. Autologous Tooth Graft after Endodontical Treated Used for Socket Preservation: A Multicenter Clinical Study. *Applied sciences*. 2019;9(24):5396-5396. doi:https://doi.org/10.3390/app9245396
17. Minetti E, Celko M, Marcello Contessi, et al. Implants Survival Rate in Regenerated Sites with Innovative Graft Biomaterials: 1 Year Follow-Up. *Materials*. 2021;14(18):5292-5292. doi:https://doi.org/10.3390/ma14185292