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Relationship between periodontal diseases and vascular diseases

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ABSTRACT:
Cardiovascular disease is the main cause of morbidity and mortality all over the world, so that it can be considered as one of the reasons for the increase in the prevalence of sudden death. Also, this disease can impose heavy costs on the patient. Atherosclerosis is the underlying cause of most cardiovascular diseases. Despite the design of new treatment methods to prevent and treat atherosclerosis, the number of deaths related to cardiovascular diseases has remained constant in most countries. . Several studies have been conducted on the role of various microbial agents of inflammatory diseases in relation to atherosclerosis. The purpose of this is to study the impact of periodontal disease on the cardiovascular system and also to review its mechanism through the collection of existing materials in this field. According to the above contents, it is very important to strictly follow oral hygiene and prevent the development of periodontal disease, and if it occurs, early treatment in preventing the development of cardiovascular diseases. Therefore, it is recommended that the people of the society receive the necessary training regarding the correct way to observe oral hygiene and become familiar with the signs and symptoms of periodontal disease, and about the disadvantages of chronicity of this disease, including its adverse effect on the cardiovascular system and, therefore, the importance Get to know the quick treatment in case of symptoms of periodontal disease.

Keywords: Cardiovascular disease, periodontal diseases, Healthcare, prevention disease

INTRODUCTION:

Cardiovascular disease is the main cause of morbidity and mortality all over the world, so that it can be considered as one of the causes of increasing the prevalence of sudden death. Also, this disease can impose heavy costs on the patient. Atherosclerosis is the underlying cause of most cardiovascular diseases. Despite the design of new treatment methods to prevent and treat atherosclerosis, the number of deaths related to cardiovascular diseases has remained constant in most countries. [1-6]

Periodontal disease is a chronic bacterial infection that is associated with the destruction of the supporting tissue of the teeth due to the chronic inflammatory response, in other words, with pathological changes in the periodontium, gum, periodontal ligament, cementum, tooth root surface and bone cavity [alveolus]. Studies have shown that this disease It affects a person's general health and can be involved in many systemic diseases including atherosclerosis [7,8].

Regarding the relationship between cardiovascular disease and dental infections, many reports have been presented since 1989. While more research is needed to fully understand the mechanisms involved, it is clear that maintaining good oral health is an important aspect of overall health and may play a role in reducing the risk of cardiovascular disease. Regular dental visits and good oral hygiene practices are essential for preventing periodontal disease and its potential systemic effects [9,10]. Several epidemiological studies have been conducted to investigate the possible relationship between periodontal disease and cardiovascular disease. [11-16] In meta-analysis studies in this field, the researchers came to the conclusion that according to the available evidence, periodontal diseases can be considered as a be considered a risk factor for developing atherosclerosis and its consequences [19-17]. Considering that periodontal disease is one of the infectious and inflammatory diseases, the inflammation caused by oral microorganisms in this disease can justify

the role of periodontal disease in the formation of atheroma and as a result the creation of atherosclerosis. Bacteria related to periodontal diseases can cause atherosclerotic plaques. to colonize and by causing local inflammation and the spread of this inflammation, lead to the formation and development of atheroma and finally its rupture. Systemic inflammation can be caused by the presence of bacteria in the blood, it may also be the result of cytokines created in the periodontal lesion that have entered the bloodstream [20,2].

Several studies have been conducted on the role of various microbial agents of inflammatory diseases in relation to atherosclerosis. The purpose of this is to study the impact of periodontal disease on the cardiovascular system and also to review its mechanism through the collection of existing materials in this field.

Inflammatory mechanism of atheroma formation:

Under normal conditions, leukocytes in the bloodstream cannot bind to the endothelium. When the endothelium is damaged by inflammatory factors. Endothelial cells increase the occurrence of adhesion molecules, and as a result, the adhesion of leukocytes to the endothelium increases. Endothelial activation is considered the first step in the formation of atherosclerotic lesions. Endothelial cells secrete chemokines under inflammatory conditions. Monocytes migrate to the inner lining of blood vessels after attaching to the endothelium, where they multiply and become activated macrophages. Monocytes and macrophages are known as components of atherosclerotic plaques. This migration is due to Emergence of matrix metalloproteinases including 9-MMP is facilitated. As a result of the increase in plasma cholesterol, lipids penetrate into the inner lining of blood vessels, and with the absorption of these lipids by macrophages, fat cells [foam cells] are formed. At the same time, macrophages release a group of pro-inflammatory cytokines that lead to the intensification of the local inflammatory response and the early stages of atherosclerosis. Apoptosis of fat cells causes the release and accumulation of lipids in the inner lining of blood vessels [20-23] Cytokines produced in atherosclerotic lesions mainly induce T helper [Th] cell response, which in turn intensifies local inflammation. to do Atheroma grow in areas of atherosclerotic lesions where macrophages and T cells infiltrate and fibrotic tissue is deposited. Smooth muscle cells migrate to the inner lining of blood vessels after breaking down the extracellular matrix by 9-MMP and other proteases. In this area, smooth muscle cells multiply under the influence of several growth factors and secrete collagen and other components of the extracellular matrix. This stage of atheroma formation is characterized by its transformation from a fat-rich plaque to a fibrotic plaque, which causes narrowing of the lumen. [25,24] There are several inflammatory mechanisms that can lead to the rupture of the fibrotic covering. The general effect of inflammation on the components of the extracellular matrix includes stimulating their decomposition and inhibiting their synthesis. Inhibitory mechanisms of collagen production reduce the collagen content of the fibrotic lining and make it prone to tearing. Rupture of this covering exposes the sclerotic lesion to the liquid phase of the blood and causes the release of a set of pro-coagulant factors that cause the formation of a thrombus and ultimately lead to the blockage of blood flow [22-28].

Oral infection in the formation of atheroma:

Much research has been done at the molecular level to determine whether oral bacteria can be related to atherosclerosis. In these studies, different methods such as polymerase chain reaction [real-time PCR [PCR hybridization, fluorescence FISH] in situ] DNA-DNA and culture of periodontal pathogens from atherosclerotic plaques have been used [26-31].

Some robots and devices can assist surgeons or clinical technicians. For example, devices equipped with tactile sensing capabilities can significantly impact surgical procedures [32,33]. The theory related to the effect of infection in causing atherosclerosis is mainly based on the study of pathogens that can cause persistent infection with long-term residence and without reproduction in cells. Factors such as cytomegalovirus [CMV], herpes simplex virus [HSV] and Chlamydia pneumoniae, which are all intracellular pathogens, are involved in atherosclerosis. [29,30,33] Therefore, when investigating the pathological mechanism of the relationship between periodontal disease and atherosclerosis, the detection of cell invasion by oral microbial species is logical. It seems that the study on periodontal pathogens has shown that a certain species of Porphyromonas gingivalis has a high invasive power, while some other pathogens have very little ability to invade. [34, 33] According to the studies, it seems that Porphyromonas gingivalis lipopolysaccharide is considered an important factor in the development of atherosclerosis by stimulating the expression of genes related to atherosclerosis in macrophages and fat cells [foam cells] [37-35].

Studies conducted on other oral microbial species such as Porphyromonas endodontalis streptococcus, mutans streptococcus oralis and some other types of streptococcus have proven the ability of these microorganisms to invade endothelial cells [36, 37].

Invasion of periodontal pathogens to atherosclerotic plaques:

Periodontal pathogens such as Porphyromonas gingivalis, Protella intermedia actinomycetem comitans, etc. have been found in atherosclerotic plaques of coronary heart and carotid arteries. Studies have shown that the invasion of Porphyromonas gingivalis causes the production of interleukin [IL6], interleukin 8 [IL8], adhesion molecules of endothelial cells, etc. Autoimmune mechanisms secondary to periodontal infections can play a role in the development and progression of atherosclerosis [38-40].

The systemic consequences of periodontal infection in patients with periodontitis have a high level of CRP [reactive protein], fibrinogen, IL6, IL, TNF-a and other factors related to the acute stage of cardiovascular diseases [1, 41]. He paid attention to the fact that the increase in the production and secretion of cytokines in the gum tissue allows these factors to enter the systemic blood flow [42, 43] Pro-inflammatory cytokines cause an increase in the incidence of endothelial cell adhesion molecules. It is obvious that the absence of antiatherogenic properties in the endothelium increases the vascular migration of leukocytes to atherosclerotic plaques [44, 45] Porphyromonas gingivalis, which is considered a periodontal pathogen, can cause the accumulation of platelets.

Platelets activated during bacteremia are responsible for the regulation of chemokines released from monocytes. In addition, Porphyromonas gingivalis is capable of causing procoagulant effects by invading endothelial cells, including increasing the occurrence and activity of tissue factor and suppressing the inhibitory pathway of this factor. It should be noted that the coagulation power of this bacterium increases with high levels of blood fat [9, 42].

Investigations have shown that changes in plasma hematocrit viscosity and coagulation factors are effective in the occurrence of cardiovascular diseases. Whole blood viscosity is related to viscosity, plasma hematocrit and the number of white blood cells. It has been reported in a study that plasma fibrinogen concentration And the number of white blood cells increases in patients with chronic gingivitis and periodontitis, increasing the number of white blood cells accelerates ischemic heart disease [42-46].

DISCUSSION:

Several factors including diabetes, obesity, smoking and high cholesterol levels can be effective in causing cardiovascular disease. severe can cause disturbances in the metabolism of fats through the immune system [48,47,42]. It is available between periodontal disease and cardiovascular disease. Based on the study of Dastfano et al., the rate of coronary artery disease in patients whose periodontal pocket depth was more than 3 mm showed a 3-fold increase [49-52].]

Another study was conducted by Metila et al. on 100 patients who had some degree of coronary artery occlusion or a history of heart attack. They concluded that bacterial infections, including dental infections, are effective in coronary atherosclerosis [53] Pinho et al. in a study proved the relationship between the severity of periodontitis and carotid atherosclerosis and suggested that periodontal disease can be a risk factor for the disease. be atherosclerotic [54] The increase in the number of white blood cells and platelets play an important role in the occurrence of thromboembolic lesions of the vessels and subsequently causing ischemia and heart attack. In a study by Siyar et al., it was shown that periodontal disease causes an increase in the number of white blood cells, especially neutrophils, as well as an increase in the number of platelets [55] in a study conducted by Kristen, it was reported that after treatment Periodontal disease in patients with aggressive periodontitis decreased the number of white blood cells and platelets [56].

It is quite understandable that the properties of oral microbes that are effective in causing atherosclerosis are significantly different from those properties that are involved in the destruction of periodontal tissue. For example, infective endocarditis is mainly caused by viridans group streptococcus, staphylococcus and enterococcus, none of which are known periodontal pathogens [57-61]. In fact, a group of other oral microbial species, including the etiological agent of dental caries, Streptococcus mutans] can be obtained from atheroma. In addition, the studies conducted on bacteremia have shown great diversity in oral microbial species that follow different stimuli. enter the bloodstream, it has been shown that from streptococcus species to anaerobic gram-negative bacteria [62-68].

Blockchain in Healthcare for Periodontal and Cardiac Diseases:

1. Patient Data Management:

- Secure Health Records: Blockchain can provide a secure and immutable way to store patient health records, ensuring that sensitive information is protected and only accessible to authorized parties.
- Interoperability: Different healthcare providers can access and share patient data seamlessly, improving care coordination, especially for chronic diseases like periodontal and cardiac conditions.

2. Clinical Trials and Research:

- Data Integrity: Blockchain can ensure the integrity of clinical trial data, making it easier to verify results and reduce fraud.

- Patient Recruitment: Smart contracts can streamline the recruitment process for clinical trials, ensuring that participants meet eligibility criteria and are compensated fairly.

3. Supply Chain Transparency:

- Pharmaceutical Supply Chain: Blockchain can track the supply chain of medications and medical devices, ensuring that they are authentic and have not been tampered with, which is crucial for patient safety.
- Dental Products: For periodontal disease management, blockchain can track the provenance of dental products and materials used in treatments.

4. Telemedicine and Remote Monitoring:

- Secure Data Sharing: Blockchain can facilitate secure sharing of data from wearable devices that monitor cardiac health, ensuring that patients' data is protected while allowing healthcare providers to access real-time information.
- Patient Consent Management: Patients can control who has access to their health data and can revoke access at any time, enhancing privacy.

5. Insurance and Billing:

- Transparent Billing Processes: Blockchain can streamline insurance claims and billing processes, reducing fraud and ensuring that patients are billed accurately for their treatments [69-72].

CONCLUSION:

According to the above contents, it is very important to strictly follow oral hygiene and prevent the development of periodontal disease, and if it occurs, early treatment in preventing the development of cardiovascular diseases. Therefore, it is recommended that the people of the society receive the necessary training regarding the correct way to observe oral hygiene and become familiar with the signs and symptoms of periodontal disease, and about the disadvantages of chronicity of this disease, including its adverse effect on the cardiovascular system and, therefore, the importance Prompt treatment should be known if symptoms of periodontal disease appear [72-75].

The integration of blockchain technology in both the gaming industry and healthcare presents numerous opportunities for innovation, efficiency, and enhanced user experience. In gaming, it can transform asset ownership and community engagement, while in healthcare, it can improve data management, patient care, and transparency. As these technologies continue to evolve, their potential applications will likely expand, leading to further advancements in both fields [76,77].

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