Influence of hypertension on oral infections and endodontic treatment

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ABSTRACT

Hypertension is characterized by peripheral vascular resistance that leads to blood pressure increase and several systemic changes that may negatively influence one's oral health. Thus, the aim of this study was to conduct a literature review on the influence of hypertension over oral conditions and endodontic treatment. Hypertension mainly affects the blood vessels, brain and kidneys. A hypertensive condition can lead to increased levels of parathyroid hormones, abnormal vitamin D metabolism, reduction in the concentration of ionized calcium and decreased calcium absorption. Therefore, hypertension can be closely associated with oral problems such as periodontal diseases, implant loss, difficulty in bone healing, reduced salivary flow and protein concentration in saliva, increased number of neutrophils and, as a consequence, favoring of inflammatory processes. It has also been suggested that the success rate of endodontic treatment in hypertensive patients is lower than in normotensive ones. The response of hypertensive patients to root canal treatment, intracanal medications and sealers should be further studied in order to provide knowledge on the changes, failures and success of endodontic treatment.

Keywords: Hypertension. Endodontics. Endodontic medicine.

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Introduction

Hypertension or "high pressure", as it is popularly known, occurs when blood pressure is equal or higher than 140/90 mmHg for a young adult. Such increase in pressure is due to vascular remodeling that hinders the passage of blood during its journey in the arteries, causing the heart to work harder than it usually does.[1-4] Heart and blood vessels can be simply compared to a system of taps connected to several hoses. If the tips of the hoses are closed, the pressure inside the taps will increase.

Hypertension is considered a "silent and democratic" chronic disease. It is silent because patients rarely have evident signs or symptoms, which contributes to late diagnosis and treatment. Moreover, it is democratic because it attacks all kinds of people, regardless of sex, age, social class or physical type.[4]

Hypertension is a chronic disorder of multifactorial etiology.[5] Its incidence has increased in the last few years due to changes not only in the dietary pattern and lifestyle of the general population, but also in the growth of the elderly population as well as an increase in human longevity.[6] For this reason, the Brazilian Society of Hypertension and the World Health Organization understood the importance of waging campaigns to raise public awareness about healthy eating habits and physical exercising.[1,7]

Moreover, hypertension is considered a very common disease, even among different age groups. It attacks 25% of the Brazilian adult population[1,7] (data that corroborates the findings of other countries.[8,9]), 50% of people older than 60 and 5% of children and adolescents,[1] affecting not only blood vessels, but also their heart, brain and kidneys.[3,5,10]

Blood vessels present a very thin and delicate inner layer that can be injured by high pressure. Consequently, blood vessels are narrowed and hardened, and can be blocked or broken over time.[1,3,5]

The blockage of a heart vessel causes angina that can lead to a heart attack. On the other hand, blockage or breakage of brain vessels lead to a stroke. High pressure is currently responsible for 40% of cases of myocardial infarction and 80% of cases of stroke. Therefore, the World Health Organization considers it a deadly disease for 9.4 million people worldwide.[1,3,5]

Changes in kidney filtration as well as renal failure can occur. In fact, researches reveal that 25% of renal failure cases are due to hypertension.[1,11] In addition to that, hypertension also causes systemic changes such as increase in the levels of parathyroid hormones, abnormal vitamin D metabolism, reduction in the concentration of ionized calcium and decreased absorption of calcium.[12] Therefore, a hypertensive condition may increase the mobilization of calcium from the bones and its consequently excretion by the kidneys. Furthermore, it may lead to a secondary activation of parathyroid hormones of which main function is to increase the level of calcium in one's blood by stimulating the breakdown of osteoclasts, as well as by increasing calcium absorption in the intestines via vitamin D activation and calcium resorption of the kidney; thus resulting in loss of calcium in the body. In addition to that, hypertensive patients present alterations in the activity and differentiation of bone cells mediated by angiotensin II.[13-16]

According to the above, clinical and experimental studies have demonstrated a causal relationship between the presence of hypertension and increased loss of calcium from the bones.[12,17,18] More than that, it can be inferred that hypertension may be closely related to dental problems such as periodontal diseases,[19,20,21] high levels of implant failure due to defects that occur during osseointegration,[22] and also difficulty in bone healing after extraction.[23-25]

Therefore, the aim of this study was to conduct a literature review about the influence of hypertension on oral problems and endodontic treatment.

Relationship between oral health problems and hypertension

Periodontal problems are closely related to hypertension.[19,20,21] Periodontal infection is a source of pathogenic species and inflammatory mediators that can create a systemic inflammatory burden and increase the risk of developing hypertension and other cardiovascular diseases.[26-32]

Bonato et al[26] observed that after induction of inflammation (periodontitis), there is an additional recruitment of neutrophils due to the increased presence of TNFα and other cytokines involved in the emission of signals to the onset of immune responses.[26]

In other words, the presence of local inflammation, such as apical periodontitis, may be systemically interfering due to the fact that hypertensive patients show an increased amount of cells, proteins and chemical mediators involved in the immune response processes.

Relationship between hypertension and oral health problems

Hypertension causes high blood pressure that may affect the arterioles along the surface of the alveolar bone, leading to a minor hemorrhage.[20,33,34] Patients with systemic diseases may have decreased resistance to bacterial infection as well decreased tissue repair after endodontic treatment.[35,36] Thus, an inflammatory process characterized by circulation of cytokines and chemical mediators with the presence of a microbiota, may be established.[20,33,34] Within this context, Bonato et al[26] observed that hypertensive rats present a higher number of neutrophils in comparison to normotensive rats. Therefore, hypertensive condition seems to favor the inflammatory process that, in turn, is potentiated.

The relationship between oral chronic inflammatory processes of infectious origin, for example, apical periodontitis and periodontal disease, and systemic health is a very interesting aspect that should be covered. In a retrospective study, Segura-Egea et al[37] found that there is a higher prevalence of chronic apical periodontitis in hypertensive patients than in normotensive patients.[37] In 2011, the authors reported that the association between higher blood pressure and smoking habits further increased this prevalence.[38]

Hypertension can also be associated with a high susceptibility to the development of pathologies that impair oral health, which can decrease salivary flow and protein concentration of saliva. Elias et al[39] found that salivary flow and average concentration of proteins in saliva were reduced, but with no changes in salivary amylase activity in hypertensive cases. Additionally, the authors also observed, by means of microhardness analysis, that teeth of hypertensive rats have lower enamel and dentin resistance.[39] Furthermore, Inoue et al[40] suggested that the mechanism of mineralization in hypertensive rats is abnormal, given that their trabecular bone presented a lower mineral state in both young and adult rats.

Moreover, hypertension can cause negative histometric and molecular changes in the alveolar bone, even in the absence of an inflammatory process. According to Bastos et al,[24] there is an increased expression of RANKL protein and a higher ratio of RANKL/OPG proteins that, when combined with other factors, decrease bone density. RANKL protein is closely related to the activation of osteoclasts responsible for the reabsorption process, whereas OPG protein is an osteoclastogenesis inhibitory factor. These data suggest that a hypertensive condition may directly affect the alveolar bone. Zhang et al[41] also found that bone mineral density is lower in hypertensive rats in comparison to normotensive rats, thus confirming increased bone loss in the presence of high blood pressure.

Corroborating and further investigating these results, Bastos et al[25] conducted a study in hypertensive rats and observed that not only the bone density of pre-existing bone is affected by hypertension, but also the newly formed tissue of the spinal region. In that study, the trabecular bone area of normotensive 150-day old rats was considerably larger than in hypertensive rats. Moreover, 8 days after bone defect was carried out, bone formation in hypertension rats was significantly lower.

It has been suggested that hypertension may contribute to difficult in retention of endodontically treated teeth. Mindiola et al[42] observed that 7.8% of endodontically treated teeth of hypertensive patients were not satisfactory. Additionally, further aggregation of diabetes to this systemic condition increased that rate. Altogether, these data justify the hypothesis that systemic diseases, such as diabetes mellitus, coronary artery disease and hypertension, increase the risk of tooth extraction after endodontic treatment or retreatment.[43]

Relationship between hypertension and Endodontics

According to the aforementioned information, hypertension promotes systemic changes that are directly related to the oral condition, healing and bone formation, mineralization processes and the process of speeding up an infection. Furthermore, these changes may be responsible for endodontic treatment failure in those patients.

Periodontal disease and chronic apical periodontitis share a common microbiota composed of anaerobic gram negative bacteria, in addition to being similar inflammatory processes.[44,45] Therefore, in this context, a possible association can be established between hypertension and endodontic treatment.

Endodontic treatment aims to restore the normality of lost apical and periapical tissues[46,47] by means of not only deeply cleaning and disinfecting the root canal system so as to control pathogenic microorganisms,

but also through complete three-dimensional sealing of the root canal with filling materials that present adequate physical and biological properties for tissue repair, by means of inducing mineralization.[48-50]

Some materials used in endodontic treatment function as anti-inflammatory and antibacterial drugs, as well as inducers of osteogenesis and cementogenesis.[48-52] Calcium hydroxide is widely used during endodontic treatment, given that it eliminates bacteria and their toxins, has an anti-inflammatory action, neutralizes acid products and activates alkaline phosphatase. All these functions are associated with tissue and bone repair processes. In addition to calcium hydroxide, MTA also induces osteogenesis and cementogenesis.[48,52-57]

Hence, the response of hypertensive patients to endodontic treatment, intracanal medications and sealers should be further studied in order to provide knowledge on the changes, failures and success of endodontic treatment.

Conclusion

Based on the results of this study it is reasonable to conclude that hypertension influences patients' overall oral health and seems to be related to success in endodontic treatment. The response of hypertensive patients to root canal treatment, intracanal medications and sealers should be further studied, in order to provide knowledge on the changes, failures and success of endodontic treatment.

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