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Association between Systemic Diseases and Endodontic Treatment Outcome- Review of Literature

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Abstract

General health conditions of a patient may influence the healing of periapical lesions and therefore the outcome of the root canal treatment. Both systemic and tooth-based factors can have a negative impact on the success of the endodontic treatment. The aim of this literature review is to investigate the impact of systemic health factors on the outcome of endodontic treatment. A review of related literature has been conducted in order to determine which systemic diseases can negatively influence the healing of periapical lesions. The outcome of treating endodontic infections might be poorer by patients with general medical conditions such as diabetes mellitus, hypertension, renal diseases, immunosuppressive conditions, etc. Tooth-based factors such as the quality of the chemo-mechanical preparation of the root canal, the quality of the root canal obturation, as well as the preoperative existence of periapical lesions, are also significant factors for the success of the root canal treatment.

Keywords: Endodontic Treatment Outcome; Systemic Disease; Medical Conditions; Tooth-Related Factors

Introduction

Apical periodontitis is a chronic infection with some essential features such as: polymicrobial pathogenesis with predominance of anaerobic bacteria and inflammatory host response with locally and systematically elevated cytokine levels. Apical periodontitis and marginal periodontitis both share these features [1]. The correlation between marginal periodontitis and systemic health disorders such as diabetes mellitus and cardio-vascular diseases has been already established and widely investigated [2,3]. Based on the similar mechanisms of both oral diseases, an association between apical periodontitis and systemic diseases may exist [4]. Systemic diseases and oral infections both share many associated risk factors [3,5,6]. Khalighinejad et al. [7] in their systematic review reported the correlation between some systemic diseases and the pathogenesis of endodontic diseases. Investigation of the relationship between systemic diseases and endodontic treatment outcome can provide valuable information on the prognosis of endodontic treatment [8]. Several systemic diseases were found to be related to the outcome of endodontic treatment [8]. Diabetes mellitus is reported to be associated with reduced healing rates in teeth with preoperative existing infection and periapical lesions [9,10]. Lima et al. [9] & Fouad et al. [10] suggested that diabetes mellitus may serve as disease modifier. Systemic diseases such as diabetes mellitus and hypertension are found to be significantly associated with reduced survival of endodontically treated teeth [11].

Many studies and literature reviews suggest that systemic medical conditions should be observed not only as etiologic factor of endodontic infections, but also as factors, influencing the healing outcome of endodontically treated teeth [3,12,13]. Apical periodontitis is an inflammatory disorder resulting from failed dynamic encounter between microbial infection of endodontic origin and subsequent host defense response. Apical periodontitis starts as local inflammation in the periodontal ligament and when untreated can lead to a larger destruction of the periapical tissues [14]. Apical periodontitis has been related to cardio-vascular diseases and diabetes [15,16]. Some studies show the interaction of cytokines resulting from apical periodontitis chronic lesions with proinflammatory and immunoregulatory mechanisms [17,18]. A review of related articles, studies and publications has been conducted in order to investigate the possible association between the presence of systemic medical conditions and the outcome of endodontic treatment of teeth with preoperative existing periapical lesions.

Results and Discussion

Diabetes mellitus is an immunosuppressive condition that can act as a disease modifier in apical periodontitis cases. Lopez-Lopez et al. [19] suggest that root canal treatments are more common by patients, suffering from diabetes mellitus. The outcome of the root canal treatment is also poorer [8]. After in inflammatory reaction, elevated levels of circulating IL-6 and TNF-α may impair

glycemic control [20]. Numerous articles report an association between diabetes mellitus and root canal treatment outcome [11,21-23]. Segura-Egea et al. [24,25] in their studies proved that diabetes mellitus patients develop periapical lesions more often than healthy patients. The same statement is suggested also by other authors [19,26]. There are also some contradictory findings [27,28]. Marotta et al. [29] & Ferreira et al. [30] reported that there is no association between diabetes mellitus and endodontic treatment outcome. Sanchez-Dominquez et al. [31] reported similar findings in 2015. Cardio-vascular diseases and infections of endodontic origin share similar inflammatory mediators in the initiation and progression of the process [32-34]. Berlin-Broner et al. [35] & Khalighinejad et al. [7] suggest an association between cardio-vascular diseases and existing periapical lesions.

The impaired immune response associated with systemic diseases together with the proinflammatory status may affect periapical healing [36]. A study by Liljestrand et al. [37] analyzed all cardio-vascular diagnoses and found no difference in the outcome of the root canal treatment between cardio-vascular patients and healthy ones. The difference in the results of the different studies can be explained with the fact that most of them did not differentiate between cases with preoperative existing infection and those with vital pulp. The most important factor for the endodontic prognoses is the presence of a preoperative periapical lesion. In cases with vital pulp the prognosis of endodontic treatment is very good, therefore the potential role of systemic diseases may be marginal. Cases with preoperative lesions have a significantly lower prognosis, and the role of systemic diseases may be more substantial [8]. A study, conducted by Fouad & Burleson [10] proved no role of diabetes mellitus on the endodontic treatment outcome of the patients, involved in the study, during a 6-year evaluation period. When only cases with preexisting periapical lesions were considered, however, a significant association existed. Azime et al. [38] in their publication stated that patients with medical conditions are not associated with poorer healing outcome after conservative orthograde endodontic treatment. Of course, not all medical conditions are the same, and the severity of the medical condition should also be taken into consideration. Also, the information according the glycemic control, as well as complete blood count with differentials, was not available for the study, so a real comparison between the patients or even within the same patient, was not possible under the limitations of the study [8].

Marending et al. [39] suggested that the condition of the nonspecific immune system can be assumed to be an important predictor for the root canal treatment outcome. In patients with deficient immune system, the healing process of periapical lesions might be burdened by residual infection in the periapical region, whilst in healthy individuals the immune system would control the infection [22]. The presence of preoperative existing periapical lesion is proven to be the single most significant factor worsening the prognosis of the root canal treatment [40]. Also tooth-based factors, along with the status of the hosts immune system and existing systemic diseases, affect the outcome of the treatment. This means that systemic and tooth-related factors should be investigated and analyzed simultaneously. Tooth-based factors, such as the technical quality of the root canal obturation, significantly affect the outcome [40]. The number of visits to treat infected root canals is also a factor, influencing the outcome of the treatment [41]. One-stop methods of treating apical periodontitis are to a great extend proven to be successful. In order to achieve that, certain clinical criteria should be met, such as lack of pain, swelling and drainage through the root canal, lack of anatomical obstacles and procedural difficulties such as formation of ledges and perforations [41]. Proper evaluation of the preoperative extend of the periapical lesion is also necessary in order to choose the suitable treatment method. Apical periodontitis due to a peri apically infected cyst or a chronic abscess, can be treated by conventional root canal therapy when the lesion is small. Both surgical and nonsurgical combinations are indicated in teeth which cannot be treated orthograde endodontically due to some obstacles [42].

The results of another study showed that the quality of the root canal filling is an extremely important factor, influencing the treatment outcome [43]. The usage of 3D-diagnostics in field of endodontics (CBCT evaluation of the preoperative extend of the periapical lesion) can point to the proper treatment decision because of some of the advantages of 3D imaging such as: providing information of the thickness of the remaining bone and extend of the lesion towards anatomic structures such as the maxillary sinus and inferior alveolar nerve [43]. The radiographic examination is still considered the most common diagnostic procedure, used to determine the existence of periapical lesions [44]. Different indexes are described in order to assess the presence of periapical pathology and give some directions for the treatment options [45-47]. Periodontal health is considered to be another prognostic determinant of the outcome of the nonsurgical endodontic treatment, which requires attention before and subsequent to nonsurgical root canal treatment [48]. Periodontal disease is one of the main reasons for tooth extraction after endodontic treatment [49,50].

Probing depth deeper than 5mm is considered associated with an increased risk of tooth loss after performing conservative endodontic treatment [51]. The bidirectional correlation between systemic diseases and periodontal infections has been widely investigated. By both adults and children, the presence of some systemic diseases such as diabetes mellitus, cardio-vascular conditions and osteoporosis can influence the existing periodontal disease. Recurrent urinary tract infections or nephrotic syndrome are considered as factors for the predisposition to early initiation of inflammatory periodontal disease, equivalent to moderate degree of gingivitis [52,53]. Another reason for the poor outcome of the apical periodontitis treatment can be caries lesions initiation and progression, leading to a reinfection of the endodontic space. Endodontically treated teeth are proven to show an increased Str. mutans count and de novo plaque formation on their surface,

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which also leads to a higher risk of caries [54]. Reasons for this could be either alteration in their biological environment or inadequacy of the marginal fit of the dental restoration [54]. The general caries risk of the individual can also influence the survival of endodontically treated teeth. The caries risk assessment is based on combination of local factors and factors, related to the general health of the individual. High caries risk is estimated in patients, suffering from systemic diseases such as diabetes mellitus, immunosuppressive conditions, urinary tract infections, nephrotic syndrome, etc. [55-58].

Conclusion

The main purpose of the endodontic therapy is to eliminate the existing infection of the root canal system by reducing the number of microorganisms through proper chemical and mechanical preparation of the root canal system. Several systemic and tooth-related factors are considered significant for the successful outcome of the root canal treatment. The outcome of endodontic treatment of teeth with preexisting periapical lesions might be poorer in patients with systemic diseases and immunodeficiency. The presence of both systemic and tooth-related factors should be taken into consideration in clinical decision-making about the treatment method and long-term prognosis of the tooth involved.

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