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CYTOKINES – AS A DIAGNOSTIC MARKER OF PULPAL INFLAMMATION

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ABSTRACT Considering the management of the decayed teeths'certain clinical signs, sensitivity tests, and radiographic findings do not provide accurate information about pulpal status. There can be a possibility of diagnosing pulpal pathological status using the cytokines that are released during the inflammation process in healthy as well as infected tooth pulp as a marker. This article emphasizes on the importance of cytokines level estimation in puplal blood that may help in the diagnosis of pulpal inflammation.

KEYWORDS : Cytokinese, Pulpal inflammation, ELISA

INTRODUCTION

Pulpotomy is a common procedure for the treatment of deep dentin caries in primary molars with no evidence of radicular pathosis[1]. It is indicated for primary teeth with asymptomatic deep dentin caries, either mechanical or carious exposure of vital pulp, no clinical or radiographic evidence suggesting irreversible pulpitis or nonvitality, and no radiographic evidence of physiologic root resorption exceeding one-third of the root length[2]. The success of pulpotomy treatment is mainly based on a clinical diagnosis of normal pulp (symptom-free and responsive to vitality testing) and reversible pulpitis (pulp capable of healing).[3]

However, there is a considerable amount of literature reporting that clinical signs, sensitivity tests, and radiographic findings do not provide accurate information about pulpal status[4], and no quantitative marker of primary molar pulp inflammation is currently available.

The possibility has been raised of diagnosing pulpal pathological status using the cytokines that are released during the inflammation process in healthy as well as infected tooth pulp as a markers.[5] Cytokines are small polypeptides secreted by leucocytes and other inflammatory cells[6] and are known to play important roles in the intensity and duration of the immune response.[7] Pro-inflammatory cytokines (IL-1 , IL-2, IL-6, IL-8, TNF-) are involved in the regulation and development of inflammation, while anti-inflammatory cytokines (IL-4, IL-10, and IL-13) play roles in its suppression. Cytokines are also involved in increasing pulp pressure and providing pulpal hemostasis.[8] Studies have emphasized that infected teeth have higher levels of cytokines than healthy teeth, making it possible to use these inflammatory markers to diagnose the pathological condition of dental pulp tissue.[9]
Assessing the cytokines level at the exposure site reflects the level of inflammation at canal orifices of primary teeth with carious pulp exposures. For measuring the level of inflammation, cytokine levels at the exposure sites and canal orifices are used.

PROCEDURE:

Following administration of local anesthesia using a solution that do not contain a vasoconstrictor, teeth are isolated with a rubber dam, a low-speed round bur is used to remove carious tooth structure, and teeth with carious pulp exposures.

To assess inflammatory markers at the canal orifice, access to the pulp chamber is created, and the coronal pulp is removed with a spoon excavator. To assess inflammatory markers at the canal orifices, a blood sample is collected by a sterile cotton pellet, which is placed in the pulp chamber adjacent to all canal orifices for 45 seconds. This is removed, and a damp cotton pellet is placed at the orifice using slight pressure to control hemorrhage.

Primary molars in which homeostasis at the exposure site is achieved in five minutes are only included.

The Primary molars are treated with vital pulpotomy with a calcium-silicate-based material (Biodentine, Septodont, Saint-Maur-des-fossés, France) and restored with stainless steel crowns.

All blood samples are immediately eluted with 0.08 ml phosphate-buffered saline (PBS pH equals 7.2) and stored at -80 degrees Celsius until analysis.

Pulpal blood samples are analyzed for IL-1β, IL-2, IL-6, IL-8, IL-10, TNF-α, and PGE2 levels (pg/ml) using Enzyme Linked-Immuno-Sorbent Assays (**ELISA**). After thawing, the blood samples are centrifuged at 1,500 g for 10 minutes at four degrees Celsius, and the cotton pellets are removed. Cytokine concentrations are measured using an Invitrogen Immunoassay Kit (DIA Source ImmunoAssays, Nivelles, Belgium) with a double-sandwich technique.

DISCUSSION

When deciding whether pulpotomy or direct pulp capping is indicated, the extent of radicular pulp inflammation is particularly hard to determine[10]. During clinical procedures, the only operative criterion available to determine the treatability these teeth is homeostasis, which is a criterion that has not previously been shown to decisively determine the level of inflammation in radicular pulp tissue. Moreover, there is no agreement as to whether homeostasis should be evaluated at the exposure site or at the canal orifice.[11] In an attempt to develop a more objective and accurate criterion for vital pulp treatment, this method may reflect the inflammatory level as determined by cytokine levels of pulp tissue at the canal orifices of primary teeth with carious pulp exposure.

Several cytokines produced and released by dental pulp cells play an important role in the pathogenesis of pulpits. An increase in IL-1β can stimulate acute inflammation; IL-2, IL-8 and PGE2, an arachidonic acid metabolite, dramatically increase during irreversible pulpitis[12]; IL-6 is associated with edema and pulpal tissue destruction[13]; and TNF-α is related to early host response and symptoms of pulpitis.[14] IL-10, on the other hand, plays a role in suppressing inflammation. Considering that pro- and anti-inflammatory cytokines are able to determine pulpal inflammatory level, these markers can be used as objective indicators of inflammation.

A pro-inflammatory cytokine produced by mononuclear phagocytes, fibroblasts, and other cells in response to the activity of other pro-inflammatory cytokines, IL-6 causes up-regulation of adhesion molecules and induces angiogenesis, leading to an increase in vascular permeability and inflammatory edema.[15]

Ozdemir et al.[16] investigated IL-1α, IL-6, and IL-8 levels in cariously and mechanically exposed primary molars for which pulpotomy was indicated. They reported IL-6 and IL-8 levels to be significantly higher in cariously exposed primary molar pulp when compared to mechanically exposed primary molar pulp, and they suggested that IL-6 and IL-8 levels had potential as indicators of pulp status that could improve the accuracy of prognoses in vital pulp therapy.

According to some authors, chronic inflammation exists in the coronal pulp of primary teeth with deep caries, because the structural characteristics of primary teeth provoke the initiation of an inflammatory response much before the caries lesion reaches the pulp.[17] If this is indeed the case, when the caries lesion does reach the pulp, bacterial invasion may engender an acute response. Thus, the ability to achieve homeostasis in teeth with higher IL-6 levels could be explained by the chronic inflammation of the coronal pulp in these teeth. On the other hand, concurrent increases in both IL-6 and IL-8 have been observed in the late phase of inflammation.

As the exposure site is closer to the carious lesion, coronal and radicular pulp inflammation is expected. Few authors has suggested lack of a direct link between homeostasis and inflammatory status of the pulp. Future studies investigating the relationship between inflammation and homeostasis in healthy and inflamed pulps can shed new light on the subject.

CONCLUSION

Pulpal blood can be a potentially good sample for pulpal diagnosis in caries exposure cases, as it is easily obtained in the clinical setting. Ratios of IL-6/IL-10 and IL-8/IL-10 cytokines may prove to be useful markers of inflammation because they provide information about the overall cytokines balances in the pulp. The cytokine IL-8 and the ratios IL-6/IL-10 and IL-8/IL-10 ratios are recommended for further investigation, as they may contribute to easy diagnosis of puplal inflammation in caries exposure.

REFERENCES:

1. American Academy of Pediatric Dentistry. Guideline on pulp therapy for primary and young permanent teeth. Pediatr Dent 2016; 38(6):280-8.
2. McDonald RE, Avery DR, Dean JA. Treatment of deep caries, vital pulp exposure and pulpless teeth. In: Mc Donald RE, Avery DR, eds. Dentistry for the Child and Adolescent. 8th ed. St. Louis, Mo., USA: Mosby; 2004: 388-412.
3. Waterhouse PJ, Nunn JH, Whitworth JM. Prostaglandin E2 and treatment outcome in pulp therapy of primary molars with carious exposures. Int J Paediatr Dent 2002; 12(2): 116-23.
4. Seltzer S, Bender IB, Ziontz M. The dynamics of pulp inflammation: correlations between diagnostic data and actual histologic findings in the pulp. Oral Surg Oral Med Oral Pathol 1963;16:846-71.
5. Zehnder M, Delaleu N, Du Y, Bickel M. Cytokine gene expression: part of host defense in pulpitis. Cytokine 2003; 22(3-4):84-8.
6. Feldmann M, Brennan FM, Chantry D, et al. Cytokine production in the rheumatoid joint: implications for treatment. Ann Rheum Dis 1990;49(suppl 1):480-6.
7. Okiji T, Morita I, Sunada I, Murota S. The role of leukotriene B4 in neutrophil infiltration in experimentally-induced inflammation of rat tooth pulp. J Dent Res 1991; 70(1):34-7.
8. Elsalhy M, Azizieh F, Raghupathy R. Cytokines as diagnostic markers of pulpal inflammation. Int Endod J 2013; 46(6):573-80.
9. Nakanishi T, Matsuo T, Ebisu S. Quantitative analysis of immunoglobulins and inflammatory factors in human pulpal blood from exposed pulps. J Endod 1995;21(3): 131-6.
10. Camp JH. Pulp therapy for primary and young permanent teeth. Dent Clin North Am 1984;28(4):651-68.
11. Matsuo T, Nakanishi T, Shimizu H, Ebisu S. A clinical study of direct pulp capping applied to carious-exposed pulps. J Endod 1996;22(10):551-6.
12. Gaffen SL, Liu KD. Overview of interleukin-2 function, production and clinical applications. Cytokine 2004;28(3): 109-123.
13. Wisithphrom K, Windsor LJ. The effects of tumor necrosis factor-alpha, interleukin-1beta, interleukin-6, and transforming growth factor-beta1 on pulp fibroblast mediated collagen degradation. J Endod 2006;32(9):853-61.
14. Rhim EM, Ahn SJ, Kim JY, et al. Stimulation of matrix metalloproteinases by tumor necrosis factor-alpha in hu-man pulp cell cultures. J Endod 2013;39(6):795-800.
15. Bender IB. Reversible and irreversible painful pulpitides: diagnosis and treatment. Aust Endod J 2000;26(1):10-4.
16. Ozdemir Y, Kutukculer N, Topaloglu-Ak A, Kose T, Eronat C. Comparative evaluation of pro-inflammatory cytokine levels in pulpotomized primary molars. J Oral Sci 2015; 57(2):145-50.
17. Fei AL, Udin RD, Johnson R. A clinical study of ferric sulfate as a pulpotomy agent in primary teeth. Pediatr Dent 1991;13(6):327-32.