Contemporary Orofacial Sciences (2023) 1(2):35-38
10.30486/cofs.2023.1993387.1014

ORIGINAL RESEARCH

Comparison of blood cell factors in patients with pulp calcification

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Received: 2023-08-08 / Accepted: 2023-09-21 / First publication date: 2023-09-28
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Abstract

Backgrounds: Pulp stones are ectopic calcifications, which might be related to the calcification of other organs with a similar pathogenesis. Therefore, dental radiographs might function as a rapid screening method for the early detection of systemic conditions. The present study aimed to compare blood cell factors in patients with pulp calcification.

Materials and Methods: This descriptive-analytical study enrolled 90 individuals in three groups: significant pulp calcification, partial and without pulp calcification. Blood factors were obtained and evaluated for and between samples of each group. Data were analyzed by chi-square test and one-way ANOVA.

Results: Based on the results, the prevalence of pulp calcification was not related to studied blood variables (p>0.05) and gender (p=0.147). But it was related to age (p=0.024).

Conclusion: The results represented no significant difference in the Plt, MCHC, MCV, Hct, Hb, RBC, neutrophil, lymphocyte, monocyte, EOS, and BAS levels of the three groups. The studied blood factors are not contributing factors to the occurrence of pulp calcification.

Keywords: Dental Pulp Calcification, Blood cell, Oral Radiology

Introduction

The types of dental pulp calcification include pulp stones and calcification. Pulp stones are the discrete calcified foci found in the pulp space of the crown and root commonly seen in posterior primary and maxillary permanent teeth (1, 2). In the radiographic images, pulp stones with a greater dimension of 200 µm are observed in different shapes and sizes as single or multiple, which can lie in dental pulp freely, adhere to the pulp chamber wall, or be surrounded by dentin thoroughly (3-5). Calcific metamorphosis is the deposition of a high amount of hard tissue in the canal dentinal wall in response to stimulation or death and consequent replacement of odontoblasts, leading to the relative or complete obstruction of the pulp chamber and root canal in the radiographic view (2). Despite the unknown etiology of pulp calcification, long-term local stimulations (e.g., deep restoration and caries), trauma, periodontal disease, physiological changes in pulp, aging, and systemic disorders are among the underlying factors (6, 7). The importance of pulp stones is that they are ectopic calcifications and may be related to the calcification of other organs (5). Systemic and localized diseases such as atherosclerosis, gout, kidney stones, bone deformities, hypercementosis, and torus palatinus are considered factors for pulp calcification (8). A strong relationship between chronic kidney disease and molar and premolar pulp stenosis has been proposed (7). Thus, the early diagnosis of calcification can help to save these patients' lives (3-7).

Nayak et al. (9) proposed a direct relationship between pulp stones and systemic disorders and found the highest percentage of stones in cardiovascular patients. In this regard, Bains et al. (3) referred to the presence of pulp stones in 38.8, 16.67, and 10% of individuals with atherosclerosis, kidney stones, and cholelithiasis, respectively. Movahhedian et al. (5) outlined that those with pulp stones are more likely to get kidney stones by examining how the prevalence of pulp stones can predict the occurrence of kidney stones. According to Alsweed et al. (10), pulp stones cannot be a diagnostic marker for carotid artery calcification. So far, most studies have focused on the relationship between systemic disorders with pulp stones and calcification, and the relationship between pulp calcification and blood cell factors has not been studied thoroughly yet. Thus, the present study aimed to evaluate blood factors in patients with pulp calcification.

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[DOI: 10.30486/cofs.2023.1993387.1014]

Materials and Method

In this cross-sectional descriptive-analytical study, 90 individuals (45 males and 45 females) in the age range of 20 to 55 years of age were selected from the outpatient Department of Oral Medicine and Radiology with accidental detection of pulp stones on digital panoramic radiographs. Ages above 55 were excluded from the study as the incidence of pulp stones increases with age (11). First, the Ethical Committee code (IR.IAU.KHUISF.REC.1398.116) and the patient's consent were obtained. Digital panoramic radiographs were evaluated twice for the presence of pulp stones.

Selection criteria

Samples had a prescription for panoramic radiography and had no other problem or disease that resulted in changes in laboratory tests (such as anaemia, polycythemia, leukaemia, allergies, infection, rheumatoid arthritis, etc.). Edentulous patients obscured panoramic images, presence of veneers, caries, restorations, periodontal disease with moderate to severe bone loss, and patients with a history of orthodontic treatment, and patients who were under Simvastatin and Corticosteroids treatment were all excluded from the study. (5, 10)

Then these people are divided into three groups: people with significant pulp calcification (n=30) (the ratio of the number of teeth with pulp calcification to the total number of teeth is more than 0.2 (0.2-1), partial pulp calcification (n=30) (the ratio of the number of teeth with pulp calcification equal to the number of teeth equal to 0.2 or between 0-0.2) and without pulp calcification (n=30) (individuals without pulp calcification, i.e. none of the teeth had pulp calcification evident in panoramic radiographs). (10)

Biochemical analysis

Two milliliters of the venous blood were collected and centrifuged to separate the serum. The main blood biomarkers: The CBC (complete blood count) measures red (RBC, 106/µl) and white blood cell (WBC, 1000/µl), and platelet (103/mm3, Plt) count, hematocrit (Hct, ratio of RBC to total blood cells), total hemoglobin (Hb, g/dl), mean corpuscular volume (MCV, mean RBC volume), mean corpuscular hemoglobin (MCH, mean amount of Hb in each RBC), and mean corpuscular hemoglobin concentration (MCHC, Hb concentration per RBC).WBC count includes the total and differential count of WBCs (neutrophils, lymphocytes, monocytes, eosinophils (EOS), and basophils (BAS)). Sample were evaluated using a Span BT-1000 fully automated package tester (TM Electronics, Boylston, Massachusetts, USA) in the same laboratory with the same technique.

Statistical analysis

The analysis was performed at two descriptive and inferential levels. At the descriptive level, mean and standard deviation, frequency distribution, and statistical charts were used. At the inferential level, to compare the quantitative values between the three groups, after checking the default of normality of the data by the Kolmogorov Smirnov test, if this default was met, the one-way analysis of variance and otherwise, the Kruskal-Wallis test was used. Chi-square and Fisher's exact tests were used to compare the qualitative values between groups. The obtained data were analyzed by chi-square test, one-way ANOVA test, and SPSS 22. Software and the error level was five percent (a p-value equal to ≤0.05 was considered statistically significant).

Results

To compare the quantitative values between the three groups, after controlling the assumption of normality of the data by the Kolmogorov Smirnov test, if this assumption was met, the one-way analysis of variance test was used, and otherwise, the Kruskal-Wallis test was used.

Based on the demographic characteristics, no significant difference was found in the gender distribution of the three groups based on the chi-square test (p=0.147) (Table 1).

Table 1. Frequency distribution of three groups under study by gender

Gender	No pulp calcification	Partial pulp calcification	Significant pulp calcification	P value
	Number (%)	Number (%)	Number(%)	
Male	9(30.0)	13(43.4)	6(20.0)	0.147
Female	21(70.0)	17(56.7)	24(80.0)	

Further, the mean age of patients was significantly different between the groups based on the one-way ANOVA test (p=0.024) so those with pulp calcification were significantly older than the other subjects (Table 2).

Table 2. Comparison between the mean age of three groups under study

Group	Number	Mean± SD	P value
No pulp calcification	30	26.93±6.47	
Partial pulp calcification	30	30.20±9.81	0.024
Significant pulp calcification	30	32.83±8.03	

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[DOI: 10.30486/cofs.2023.1993387.1014]

The three groups revealed no statistically significant difference regarding WBC and Plt, Hb, Hct, neutrophil, lymphocyte, monocyte, eosinophil (EOS), and basophil (BAS) level, MCV, MCH, MCHC, and red cell distribution width-CV (RDW-CV) based on one-way ANOVA test ($p>0.05$) (Table 3).

Table 3. Comparison between the mean blood cell factors in the three groups under study

Index	No pulp calcification	Partial pulp calcification	Significant pulp calcification	P value
	Mean ± SD	Mean ± SD	Mean ± SD	
RBC count	0.65±4.99	0.48±5.06	0.63±4.85	0.372
WBC count	2.36±6.98	1.47±7.38	2.43±7.32	0.736
Hb level	2.12±14.03	1.49±14.37	1.54±13.80	0.447
Hct level	6.07±42.77	4.46±43.57	4.40±42.26	0.599
MCV	5.59±85.23	5.04±85.50	6.31±88.23	0.082
MCH	2.47±27.88	2.16±28.07	2.47±28.72	0.356
MCHC	1.34±32.55	1.59±32.93	1.48±32.53	0.503
RDW-CV	1.71±13.46	0.81±13.09	0.98±13.20	0.489
Plt count	52.24 ± 251.77	44.91±243.53	58.05±242.07	0.739
Neutrophil count	8.97±52.36	6.94±54.15	9.09±52.00	0.572
Lymphocyte count	7.70±38.78	7.30±37.17	7.80±38.86	0.624
Monocyte count	1.98±5.53	1.84±6.18	1.89±5.63	0.362
EOS count	2.19±2.78	1.32±2.16	1.55±2.26	0.432
BAS count	0.32±0.44	0.22±0.35	0.26±0.39	0.610

RBC : Red Blood Cell
WBC : white Blood Cell
Hb : hemoglobin
Hct :hematocrit
MCV : mean cell volume
MCH : mean cell hemoglobin
MCHC : mean corpuscular hemoglobin concentration
RDW-CV : red cell distribution width- cell volume
Plt : platelet
EOS: eosinophil
BAS: basophil

Discussion

Despite the unknown etiology of pulp calcification, it has been proposed that this is more affected by age, therapeutic measures, chronic caries, periodontal diseases, and secondary conditions to calcium metabolism like hyperkalemia, gout, and kidney stones (7). Studies have focused on the relationship between the levels of blood cell factors with calcification in other organs and confirmed the relation between WBC count and coronary artery calcification (12). A positive significant association between neutrophil-lymphocyte ratio and mitral annular calcification has been suggested (13). The results of a study examining the relationship between pulp calcification and ischemic heart diseases indicated more significant calcification among patients with cardiovascular diseases. Therefore, pulp calcification in panoramic radiography can be used for screening life-threatening cardiovascular disease (14).

In the present study, the gender distribution of the three groups was not related significantly to the evolution of pulp stones. Ranjitkar et al. (15) found no statistical difference between Australian men and women in terms of the prevalence of pulp stone based on the panoramic images. According to Bains et al. (3), pulp calcification is more prevalent among women compared to men although their difference was not found to be statistically significant (7).

The comparison of age distribution in three groups demonstrated aging increases the probability of pulp calcification, which is consistent with the results of several studies (16-18) Local factors such as caries, dental surgeries, periodontal diseases, and tertiary dentin might have a role in dental pulp calcification by aging (16). Formerly, researchers have suggested a direct relation between aging and ectopic calcification in other organs like mitral annulus, coronary and carotid artery calcifications, and kidney stones (17-19).

In the case of RBC and WBC count, the results of the present study represented no significant difference among the groups. Korkmaz et al. (12) outlined that leukocyte number is significantly related to coronary artery calcification. Hb, Hct, MCV, MCH, MCHC, and RDW-CV had no significant relationship in all studied groups. Vezzoli et al. (20) emphasized that blood factors

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[DOI: 10.30486/cofs.2023.1993387.1014]

are not notably related to calcification of abdominal aortic aneurysm, although it was significantly related to MCH and MCV. Based on the results of the present study, the Plt, neutrophil, lymphocyte, monocyte, EOS, and BAS counts of all subjects were normal and had no significant difference between the groups. Varol et al. (21) reported a significantly greater mean Plt volume in the individuals with calcified mitral annulus, and a significant relationship between high Plt volume and calcified mitral annulus. In another study, the same researchers proposed a notable ratio to neutrophil-lymphocyte ratio (13). The results are not in line with those of the present study. The contradiction might be due to the more peripheral blood arteries and their lower blood flow velocity in pulp compared to those in other organs (22). Consequently, the change in the cells less influences the blood arteries of the dental pulp. The difference in the calcification mechanism of pulp and other organs can be addressed as another reason for the inconsistency.

Conclusion

Blood factors did not show a relation to the occurrence of pulp calcifications. Similar studies in this field are recommended, highly.

Conflict of interest: None

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