PULP STONES CAN HELP IN DETECTION OF CALCULUS IN THE KIDNEYS AND/OR IN THE BILE – FACT OR FICTION?

Pavlina Aleksova¹, Vladimir Serafimoski², Mira Popovska³, Milčo Ristovski⁴

¹ Department of Restorative Dentistry and Endodontics, Faculty of Dental Medicine, Ss Cyril and Methodius University, Skopje, R. Macedonia
² Macedonian Academy of Sciences and Arts, Skopje, R. Macedonia
³ Department of Periodontology, Faculty of Dental Medicine, Ss Cyril and Methodius University, Skopje, R. Macedonia
⁴ Institute of Pathology, Medical Faculty, Ss Cyril and Methodius University, Skopje, R. Macedonia

Corresponding Author: Dr. Pavlina Aleksova, Ss Cyril and Methodius University, Faculty of Dental Medicine, Department of Restorative Dentistry and Endodontics, Vodnjanska 17, Skopje, R. Macedonia, Tel. +389 (0)2 45 57 91, Mob. 070 26 03 08, E-mail: pavlinaaleksova@yahoo.com

Abstract

Background: Pulp stones or denticles are frequently found in the dental pulp; there is, however, scarce evidence about this phenomenon. Regardless of the obvious endodontic problem of inhibiting access to the canals and their further treatment, they have not been given great importance. The latest experiences of scientific and practical research, including examinations of dental calcifications and their association with calcifications/calculi in the organism, have not been included in the literature.

Aim: To investigate the possible association between dental calcifications and calculi in the kidney and/or bile.

Methods: The study group included 200 patients diagnosed with pulpitis chronic. All patients underwent dental and systematic examinations. Dental examination included x-rays, which detected the presence of calcifications in the dental pulps. Histopathological analysis of extirpated pulps was also made. Clinical examination comprised ultrasound that detected calculi.

Results: The results of the histopathological analysis of the extirpated pulps from the group of patients without denticles, but with calculi in their kidneys, bile and/or other organs, showed a regular presence of "sand" in large quantities in dental pulps. The presence of "sand" was depicted as presence of dystrophic calcifications. There was a percentage difference between the two groups: calculi in the organism (kidney and bile) and denticles – 70% and calculi in the organism without denticles -30%. The Student’s t–test showed a statistically significant difference for \( P = 0.0000 \). This study defines the association between the calculi in the organism and the presence of dental calcifications, as well as their possible bacterial association.

Key words: teeth, dental calcification, kidney calculi, bile calculi.

Introduction

Dental calcifications, known as denticles in the pulp tissue, are actually deposits of solid mineralized tissue in the coronary and/or radicular space of the teeth. They are a sort of discrete calcification bodies with definite but very different location, prevalence and histology. These bodies under the term of dental pulp nodules were first mentioned by Norman and Johnston in 1921. This term has in time been replaced by the term denticles. In recent literature the term "dental nodules" has appeared.

Regardless of the historical transformation in their nomination, they have been des-
scribed as unique "calcifying changes including diffuse pulp calcification, i.e. dystrophic calcification".

The number and size of the stones vary, and hence one tooth can have 1 to 12 stones of different size. Moss Salejin and Hedricks – Klyvert [1] described the different prevalence of calcifications in teeth, which can vary from 7.5% to a high prevalence of 90%. [2–12].

Based on the symptomatology, the calculous presence is at times asymptomatic, but at other times painful. Their close location to the nerve bundles and their more massive dimension might lead to compression of the nerve endings, provoking a painful sensation [2, 13, 14].

The pain is of neuralgic nature, it is long-lasting and occasional. It irradiates towards the temple and the corresponding side of the head [2, 13–15]. Denticles have been discovered in both dentitions (primary and permanent); they also appear in intact, periodontopathic and impacted teeth [2, 16–19].

They are most frequently spotted in molars (the upper first molars). Based on the location, they are more frequently present in the coronary and less frequently in the radicular portion of the pulp with a predominating tendency to appear in the upper jaw teeth [2, 15]. The distribution based on gender points to a greater prevalence in males, in both jaws, though according to some authors females are also affected, but without a significant difference [2, 15].

In recent years there has been growing evidence that presence of denticles in teeth poses a clear indication of the presence of calculi in the kidney and/or in the bile or in other organs [20–23]. This would practically imply that the presence of denticles suggests increased calcification not solely in the dental pulp but in other organs as well.

This pathological calcification, in addition to being due to other already familiar etiological factors, is also due to blood bacteria, known as nanobacteria, now renamed into nanoparticles or calcifying nanoparticles [24–35].

Material and Methods

A total of 200 patients randomly selected, aged between 20 and 60, diagnosed with pulpitis chronica at the Department of Restorative Dentistry and Endodontics, Faculty of Dental Medicine in Skopje have been followed-up utilizing a specially designed questionnaire of systematized recording of important clinical parameters.

For the purposes of X-ray assessment of the jaw, panoramic and retroalveolar X-rays by Dick in suspicious teeth were made. For the realization of the set objective, visual analysis of the X-rays was conducted.

Sand and calculi in kidneys and bile duct were diagnosed by application of modern imaging methods.

All patients were divided into three groups:
– The first group consisted of 70 patients with either sand or calculi in their kidneys and with denticles in their teeth;
– The second group consisted of 70 patients with calculi in the bile and with denticles in their teeth.
– The third group consisted of 60 patients who did not exhibit any presence of denticles in the dental pulp, but were registered to have calculi in their kidneys or bile. This was the control group, in which localized toothaches were recorded.

These two groups are presented in the statistical analysis (Figure 1) as calculi in the organism and denticles.

– The third group consisted of 60 patients who did not exhibit any presence of denticles in the dental pulp, but were registered to have calculi in their kidneys or bile. This was the control group, in which localized toothaches were recorded.

This group is presented in the statistical analysis (Figure 1) as calculi in the organism.

Anamnestic data were confirmed with radiological results.

The results obtained with radiological analysis were statistically processed with t-student’s distribution or student t-test at the Institute of Epidemiology and Biostatistics, Medical Faculty, Ss Cyril and Methodius University in Skopje.

Upon indicated extirpation of the dental pulp, the extirpated pulp tissue was sent for histopathological analysis at the Institute of Pathology, Medical Faculty in Skopje.

For the purposes of the histological and morphological analyses various methods and procedures were applied: fixation, decalcination, tissue processing, obtaining paraffin sections, standard staining, differential staining, microscopy, and morphological analysis with photographing.

Extirpated pulps of the 60 teeth diagnosed with pulpitis chronica from the control group were sent for a histopathological analysis (Table 1).
Pulp stones can help in detection of calculus in the kidneys and/or in the bile – fact or fiction?

Table 1

<table>
<thead>
<tr>
<th>Side</th>
<th>Left</th>
<th>Right</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tooth</td>
<td>8</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Maxilla</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>4</td>
</tr>
<tr>
<td>Mandible</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

The sand and the calculi in the kidneys and in the bile were diagnosed using up-to-date imaging methods. The results were statistically analyzed with the student t-test at the Institute of Epidemiology of the Medical Faculty in Skopje.

**Results**

Based on the data obtained from both personal and family history of the patients with denticles who had calculi in their kidneys and/or bile, it was possible to obtain results regarding location of the calcification and the calculi. These patients were referred for radiographic images, which were necessary for diagnosing pathological calcification in the teeth and in other organs (Fig. 1, 2).

![Figure 1 – Coronary localized massive denticle in the upper left first molar](image1)

Figure 1 is an X-ray retro-alveolar image that accidentally depicted a coronary fixed denticle in the upper left first molar, asymptomatic despite its size; the patient’s pain originated from the second molar. Figure 2 is an ultrasound image of the kidney of the same patient, that detected a calculus in the kidney.

![Figure 2 – Kidney calculus in the same patient](image2)

The results of the extirpated pulps obtained from the histopathological analysis of the third group of patients, those without denticles but with calculi in the kidneys, bile, and/or other organs, revealed a regular presence of "sand" in large quantities in the pulps of all 60 patients (Fig. 5–9).

![Figure 3 – Denticles in the lower left first and second molar in patient with bile calculi](image3)
Figure 4 – Bile calculi in the same patient

Figure 5 is a calculus in a patient's kidney without present denticles. Figure 6 is of more in number, different in size, partially decalcinated calcifications, otherwise known under the name of dystrophic calcifications. The image is in the same patient (Fig. 5).

Figure 5 – Calculus in patient's kidney without radiologically detected present denticles

Figure 6 – Staining by Von Kossa, 10 × 10 magnification

Figure 7 – Bile calculi in patient without radiologically detected present denticles.

Figure 8 – The image presents a larger part of the dental pulp, the middle part. The calcifications are spotted in the form of longitudinal, irregular in shape, darker purple colourings. Dental pulp is in the same patient (Fig. 7).

Figure 7 – Bile calculi in patient without radiologically detected present denticles

Figure 8 – The image is enlarged 10 × 4, HE staining

Figure 9 – the image is another part of the dental pulp, the proximal part. The calcifications are spotted as irregular in shape, different in size, dark-purple deposits.

All 200 patients were divided into three groups (Table 2):
– The first group consisted of 70 patients with either sand or calculi in their kidneys and with denticles in their teeth;
– The second group consisted of 70 patients with calculi in the bile and with denticles in their teeth.
Pulp stones can help in detection of calculus in the kidneys and/or in the bile – fact or fiction?

These two groups are presented in the statistical analysis (Figure 10) as calculi in the organism and denticles (Table 3).

– The third group consisted of 60 patients who did not exhibit any presence of denticles in the dental pulp, but were registered to have calculi in their kidneys or bile. This was the control group, in which localized toothaches were recorded.

This group is presented in the statistical analysis (Figure 10) as calculi in the organism.

Table 2

<table>
<thead>
<tr>
<th>Groups</th>
<th>Calculi in organism and denticles</th>
<th>Calculi in organism without denticles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patients with calculi in kidney and denticles</td>
<td>70</td>
<td></td>
</tr>
<tr>
<td>Patients with calculi in the bile and denticles</td>
<td>70</td>
<td></td>
</tr>
<tr>
<td>Patients with calculi in kidney and bile without denticles</td>
<td>60</td>
<td></td>
</tr>
</tbody>
</table>

Table 3

<table>
<thead>
<tr>
<th>Patients</th>
<th>No</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>All patients</td>
<td>200</td>
<td></td>
</tr>
<tr>
<td>Calculi in organism and denticles</td>
<td>140</td>
<td>70</td>
</tr>
<tr>
<td>Calculi in organism</td>
<td>60</td>
<td>30</td>
</tr>
</tbody>
</table>

Discussion

The great impact of the pathological calcification on men is the reason we have chosen this field as our subject and a project to focus on. Until recently, thousands of published papers have reported on calcification; however, there have been no published studies regarding the association of the entire pathological calcification in the organism. A number of authors have pointed out this fact [4, 8–11].

It seems that dentists/medical doctors are not familiar with the fact that pathological calcification is not a separate disease, but rather included in many diseases.
In the realization of the clinical segment of this research, the application of contemporary imaging methods in examining pathological calcification helped us in radiological examination diagnosing pathological calcification [Fig. 1–5, 7].

For a long time X-ray and computer tomography were used for the detection of calcifying deposits, but not of molecular or cellular level [4]. Staining of tissue samples clearly indicates the calcifying particles [Fig. 6, 8, 9].

The difference in the percentages registered between the two groups, calculi in the organism (kidney and/or bile) and denticles – 70% and calculi in the organism without denticles – 30%, was statistically significant for P = 0.0000, and was analysed with the studentt-test. This difference speaks clearly about the association of dental calcification and pathological calcification in the organism. We assume that this significant difference is of vital importance since, when a dentist detects and diagnoses a denticle in the coronary part of the pulp, i.e. at the canals' entrance, he/she should immediately send the patient for an ultrasound diagnosis of the abdomen, primarily of the kidneys and the bile. In the majority of our patients a positive diagnosis was established; calculi detected for the first time in the kidneys and/or bile, and often in other organs as well.

The treatment should start with timely detection of the calculi in the kidney and/or bile in order to avoid complications that might prove quite dramatic and risky for the patient. Conversely, data from the anamnesis of the patients, who have experienced inexplicable pain in the jaw, and have verified the presence of a renal stone or a gall stone, are indicators of the presence of denticles, which might help in unjustified tooth/teeth extraction. This is also relevant for patients who had previously undergone calculus removal, since calcification is a reversible process and it “returns” most often within three to four years either to the same or a new location in the organism. This has already been confirmed in many published studies [4], and is in agreement with our findings. We believe that this kind of analysis of the teeth has yielded a new diagnostic clinical method for detecting sand or stones in kidneys, bile, and/or in other organs.

The control group of patients was without verified X-ray presence of denticles, but with pathological calcification elsewhere in the organism. However, based on the medical histories of patients who were experiencing pain, upon an indicated vital extirpation of the dental teeth, and bearing in mind the histopathological analysis, we came to the surprising result that the pulps of all these patients were "full" of "sand", i.e. they all had focally partial or diffuse calcification.

This new finding can help us in diagnosing patients with inexplicable pain in a certain tooth or a region and instruct us in taking more extensive anamnesis of a patient for diagnosing calculus or calcification in the whole organism. Consequently, this would help in avoiding unjustifiable extraction of tooth/teeth. In such cases pulp extirpation will be the right choice of treatment since the "sand" cannot be verified with an X-ray, yet it can be certainly confirmed histologically. During endodontic treatment dentists very often come across an extirpated pulp in a solid form, which is an indication that pulp calcification has begun, and it also indicates the presence of pathological calcification in other organs.

Patients with a localized constant or occasional but persistent inexplicable pain in the jaw, connected with a headache on one side that had lasted for even five to six years, most often came with a complete radiological documentation, including ECG, EMG, CT-tomography of the head, X-rays of the neck, MR, as well as with diagnosed spondylosis, arthropathy, neuralgia, myalgia, etc. In addition to these examinations, we indicated panoramic and retroalveolar X-rays of the relevant teeth, and we removed detected denticles, thus achieving pain relief in those patients. Contrary to this, in patients who had no verified X-ray presence of denticles, after vital extirpation of the relevant dental pulp and a histopathological analysis, we detected the presence of a focally partial or diffuse calcification in the pulp.

Our results are consistent with data presented by Olivares and Ovalle [7].
The following conclusions can be drawn from this research:

1. This largely significant presence of the denticles in the teeth of patients with calculi in their kidney or bile of 70%, as opposed to patients with a pathological calcification in the organism without dental calcifications of 30% [Fig. 10], yields a new diagnostic and clinical method for the detection of sand and stones in the kidney, bile and/or in other organs.

2. After diagnosing patients with pulp denticles, the dentist should refer the patient for further examinations for the detection of pathological calcification in the organism. Ultrasound (echo) examinations of the abdomen are of highest priority. By early detection of histopathological calcification, surgical interventions and possible post-intervention complications might be prevented.

3. Conversely, data from the anamnesis of patients who have experienced inexplicable pain in the jaw, and have verified presence of a renal stone or a gall stone, are indicators of pulp denticles, which might help in unjustified tooth/teeth extraction. This is also relevant for patients who have previously undergone calculus removal since calcification is a reversible process and it "returns" most often within three to four years either to the same or a new location in the organism.

4. The fact that in all pulp samples of the 60 patients without denticles who experienced inexplicable pain in a certain tooth or a whole region, and who were diagnosed with calculus/calcification in the organism, and in whom a focally partial or diffuse calcification was histopathologically detected, implies the conclusion that the presence of pathological calcification in the organism is regularly associated with the presence of so-called "sand" in the dental pulp, which is the cause of the inexplicable pain.

5. Analyses with the help of X-rays need to be scrutinized more attentively and more carefully, especially the panoramic images of the whole jaw that allow the detection of dental calcification in asymptomatic teeth as well. This disease is presented with not very specific symptoms, which imposes the need for an analysis that is different from the usual routine method, as well as medical observation, in order to avoid omission or errors regarding cases of this kind.

REFERENCES


Резиме

ОТКРИВАЊЕ НА КАМЕН ВО БУБРЕГ ИЛИ ЖОЛЧНО ЋЕСЕ ПРЕКУ ЗАБИТЕ – ФАКТ ИЛИ ФИКЦИЈА?

Павлина Алексова¹, Владимир Серафимовски², Мира Поповска³, Милко Ристовски ⁴

¹ Клиника за реставративна стоматологија и ендодонција, Стоматолошки факултет, Универзитет Св. Кирил и Методиј, Скопје, Р. Македонија
² Македонска академија на науките и уметностите, Скопје, Р. Македонија
³ Клиника за пародонтологија, Стоматолошки факултет Св. Кирил и Методиј, Скопје, Р. Македонија
⁴ Институт за патологија, Медицински факултет, Универзитет Св. Кирил и Методиј, Скопје, Р. Македонија

Вовед: Пулпните камчиња, односно ден- тиките се чести во пулпита на забот, но за тоа сознание се скудни. Независно од очигледниот ендодонтички проблем на спречување на пристапот во коренските канали и нивната понатамошна обработка, останува да не им се придава толку голема важност.

Најновите искуства од научните и прак- тичните истражувања не се внесени во секојдневната литература, како што е поврзувањето на денталните калцификати од ден- талните калцификати на калцификати от- кривени со пулпата на забот, како и хистопатолошка анализа на екстриерирани пулпи. Од интернистики аспекти калцификатите беа откриени со примената на ехо дијагностичка метода.
Резултати: резултатите добиени со хистопатолошка анализа на екстрипираниите пулипи, од групата на пациенти без присуство на дентикли, а кои имаат калкулуси во бубрег, жолчно кесе и/или на друга локализација во организмот, покажаа редовно присуство на „песок“ во големи количини во пулипите на сите испитувиани пациенти, со што се потврдува постоене то на единствен калифицирачко-заболувачски синдром. Присуството на „песок“ претставено е како присуство на дистрофични калифициации.

Процентуалната разлика, регистрирана е помеѓу двете групи: калкули во организам (бубрег и жолчно кесе) и дентикли – 70% и калкули во организам без дентикли – 30%. Оваа разлика е статистички сигнификантна за \( P = 0.0000 \), добиена со помош на Студентовиот \( t \) – тест.

Со ова истражување се дефинира поврзаност помеѓу калкулусите во организмот и присуството на дентални калифицикати како и нивната можна бактериска асоцираност.

Ключни зборови: заби, денталната калифицирација, камен во бубрег, жолчно кесе.