Evaluation of endo-perio lesions according to different specific classifications

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Abstract

Introduction: Endo-perio lesions, beyond the clinical examination, are also assessed by means of radiographs. It is important that the radiographs used for diagnosis are accurate periapical radiographs, based on specific criteria. The study is of cross-sectional type with the collection of radiographic data on the appearance of endo-perio lesions in accurate periapical radiographs. The aim of the study is to evaluate the radiographic signs of endo-perio lesions, to enable the radiographic diagnosis of the lesions and then to divide them according to the subdivisions of the classification system of endo-perio lesions.

Materials and methods: The study included 104 periapical radiographs of patients presented to a dental clinic, with objective and subjective complaints of the presence of endo-perio lesions. The radiographs were classified according to the accuracy criteria of periapical radiographs, criteria defined by Prichard. Accurate periapical radiographs were used to classify endo, perio, endo-perio lesions. Endo-perio lesions were classified based on the Simon et al classification and the Torabinejad and Trope classification.

Results: The distribution of radiographs depending on the presence of endo or perio lesions varies as follows: endo lesions were presented in 32 cases or in 38% of the radiographs; perio lesions were present in 22 cases or in 26% of the radiographs and endo-perio lesions were in 30 cases or in 36% of the radiographs included in the study.

According to the classification Simon et al. radiographs were divided: class a 40%, class b 20% class c 7% class d 10% and class e 23%.

According to the Tobabinejad and Trope classification, endo-perio lesions were according to classes specifically: class a 60% class b 17% class c 23%.

Conclusions: The main violation of the accuracy criteria of radiographs is mostly related to the displacement of the cone in the up-down direction, which is performed in support of the routine protocol in performing periapical radiographs.

The values in the study showed results on the frequency of occurrence relatively the same for both endo lesions and periodontal and in cases of occurrence of endo-perio combination. This data confirms the fact that endo-perio lesions have the same possibility of occurrence, both for endo-only lesions and for perio-only lesions. Despite the different types of endo-perio lesion classification, the distribution across the classification classes shows the same values in equal percentages for true combined endo-perio lesions.

Introduction

Endo-perio lesions are lesions that differ from each other according to the different classifications of these pathologies, depending closely on the site of the beginning of the infection and, subsequently, the appearance of the primary signs of inflammation. Despite the different classifications of endo-perio
lesions, the oral flora that induces the beginning of the lesion is different, depending on the place of origin of the infection-inflammation. It is understood that the carious lesion of a tooth surface, when it penetrates towards the dental pulp, passes to the pulp and the possibility that the pulp is accompanied by the appearance of periodontium around the affected tooth, will be diagnosed as an endo-perio lesion with primary endodontic strand of the lesion. On the contrary, it is the periodontal lesion which, after the appearance of clinical signs, allows the specific bacterial flora of periodontal diseases to spread, to pass into infection of the pulp chamber and dental pulp tissues, to be a primary periodontal lesion and a secondary lesion with endodontic origin.\(^{(1-5)}\)

Seen from this point of view, the classifications of endo-perio lesions are always evolving and in technical change, which find their expression in the technical application of the classification, to facilitate the dentist in the correct establishment of the dental diagnosis and then, facilitate and the possible treatment of the affected tooth.

The radiographic appearance of these lesions is specific, although there are logical overlays.

2-dimensional radiography cannot show the moment or the time of the action and appearance of inflammation both in the case of endo lesions and in the cases of perio lesions.\(^{(2,6-10)}\)

The study aims to evaluate endo-perio lesions and classify clinical cases recorded by accurate periapical radiographs.

The accuracy of periodontal radiographs was evaluated according to the criteria for the accuracy of periapical radiographs for periodontal evaluation of teeth, established by Prichard.\(^{(2,7,11-15)}\)

The classification of endo-perio lesions is also under the dome of the classifications of periodontal diseases, therefore the changes in the classifications of periodontal diseases will also be reflected in the possible changes in the classifications of endo-perio lesions.

Their association with periodontal abscesses is another help for the dentist, in establishing the fastest and most accurate clinical diagnosis for cases of endo-perio lesions, also performing the differential diagnosis with periodontal abscess.\(^{(2,5,11,16-22)}\)

Periodontitis, as an infection of the tooth-bearing structures, can spread to the areas surrounding the inflammation. Spread to further bony structures, neighboring structures, is the logical involvement of inflammation. The spread of inflammation with mechanical orientation, towards the opening of accessory canals, apical foramen and dental tubules is spread that affects and has inflammatory vulnerability of the dental pulp.\(^{(1,2,16,23-26)}\) There is no accurate data in the literature that this spread is documented. This route of spread of inflammation is thought to exist as a possibility, but it is not as well documented as the other route of spread of inflammation, that is, from the pulpal tissues to the tooth-bearing structures. In the literature, the term retrograde pulpitis has been used to express exactly this transition of inflammation from the periodontal tissues to the dental pulp. markers of inflammation
appear in cases of infection passing from the periodontitis present on the lateral surface of the tooth, against the pulp.\(^{(6,27−30)}\)

The study is of cross-sectional type with collection of radiographic data on the appearance of endo-perio lesions on accurate periapical radiographs. As a primary aim or goal, the study has the evaluation of the radiographic signs of endo-perio lesions, to make possible the radiographic diagnosis of the lesions and then, the division according to the subdivisions of the classification system of endo-perio lesions.\(^{(6,11,15,27,31−37)}\)

The ratios and percentages of teeth classified and listed under these two classes of oral-dental morbidity also make it possible to collect data about the prevalence of these two types of pathologies, which have different habits and vulnerabilities in the oral cavity, favored by factors that act locally, but also factors that act systemically from the affected organism.\(^{(38−43)}\)

**Materials And Methods**

The study aims to evaluate endo-perio lesions based on radiographic examinations, to classify them according to two classification systems of these lesions. For the study, 104 periapical radiographs of patients presented to the dental clinic, with objective and subjective complaints of the presence of endo-perio lesions, were examined.

The radiographs were classified according to the accuracy criteria of periapical radiographs, criteria defined by Prichard. Depending on the classification of accuracy criteria, those radiographs that did not meet these criteria were excluded.

Stages of the work protocol:

• Patients presenting to the dental clinic with objective and subjective complaints of endo-perio lesions were registered.

• X-ray or x-rays were performed for the area and tooth where the endodontic or periodontal lesion appeared,

• A radiograph was performed for the presented case, a routine procedure of periapical radiography, without claiming to re-perform the radiograph if it did not meet the accuracy criteria,

• The total radiographs were evaluated for the criteria of accuracy of periapical radiographs, criteria specified by Prichard,

• Of the total radiographs, only radiographs that met the criteria of accuracy according to Prichard were included in the final evaluation.

• Accurate periapical radiographs were used to classify endo, perio, endo-perio,
• Endo-peri lesions were classified based on Simon et al. classification and Torabinejad and Trope classification.

## Results

After collecting the data in the basic excel table, they were processed with the aim of displaying the results of the study according to the tables below.

### Table 1. Division of radiographs depending on the fulfillment of the criteria for accurate radiography.

<table>
<thead>
<tr>
<th>X-rays</th>
<th>Radiologically accurate</th>
<th>%</th>
<th>Radiologically incorrect</th>
<th>%</th>
<th>Total -%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perio - correct</td>
<td>84</td>
<td>81%</td>
<td>9</td>
<td>9%</td>
<td>93-89%</td>
</tr>
<tr>
<td>Perio - incorrect</td>
<td>6</td>
<td>6%</td>
<td>5</td>
<td>5%</td>
<td>11-11%</td>
</tr>
<tr>
<td>%</td>
<td>90-87%</td>
<td>87%</td>
<td>14-13%</td>
<td>14%</td>
<td>104-100%</td>
</tr>
</tbody>
</table>

Based on the criteria for an accurate periapical radiograph that can be used for periodontal evaluation of the tooth in table 2 and graph 2 are presented periodontally incorrect graphs depending on which criteria they were evaluated as incorrect.

### Table 2. Table 2 shows the error of periodontal radiographs depending on which criterion this error is.

<table>
<thead>
<tr>
<th>Patients</th>
<th>No. of X-rays</th>
<th>% of error</th>
<th>% of coverage</th>
<th>% of coverage</th>
<th>% of coverage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Criterion 1</td>
<td>11</td>
<td>100%</td>
<td>18%</td>
<td>8-72%</td>
<td>9- 82%</td>
</tr>
<tr>
<td>Criterion 2</td>
<td>2</td>
<td>18%</td>
<td>-</td>
<td>2-18%</td>
<td></td>
</tr>
<tr>
<td>Criterion 3</td>
<td>6</td>
<td>55%</td>
<td>-</td>
<td>55%</td>
<td></td>
</tr>
<tr>
<td>Criterion 4</td>
<td>-</td>
<td>0%</td>
<td>-</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Total</td>
<td>19</td>
<td>170%</td>
<td>73%</td>
<td>72%</td>
<td>100%</td>
</tr>
</tbody>
</table>

### Table 3. Table 3 shows the distribution of radiographs depending on the presence of endo or peri lesions.
Table 4. The table summarizes the data of the radiographs for the classification of endo-perio lesions according to the classification Simon et al.

<table>
<thead>
<tr>
<th>X-rays</th>
<th>Nr.</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Endo lesions</td>
<td>32</td>
<td>38%</td>
</tr>
<tr>
<td>Perio lesions</td>
<td>22</td>
<td>26%</td>
</tr>
<tr>
<td>Endo-Perio lesions</td>
<td>30</td>
<td>36%</td>
</tr>
<tr>
<td>Total</td>
<td>84</td>
<td>100%</td>
</tr>
</tbody>
</table>

Table 5. The table summarizes the radiographic data for the classification of endo-perio lesions according to the Torabinejad and Trope classification.

<table>
<thead>
<tr>
<th>X-Rays</th>
<th>No.</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class a</td>
<td>12</td>
<td>40%</td>
</tr>
<tr>
<td>Class b</td>
<td>6</td>
<td>20%</td>
</tr>
<tr>
<td>Class c</td>
<td>2</td>
<td>7%</td>
</tr>
<tr>
<td>Class d</td>
<td>3</td>
<td>10%</td>
</tr>
<tr>
<td>Class e</td>
<td>7</td>
<td>23%</td>
</tr>
<tr>
<td>Total</td>
<td>30</td>
<td>100%</td>
</tr>
</tbody>
</table>

Figures 1-6 show some of the patients included in the study.

Periapical radiographs should be evaluated initially for their accuracy, both for radiographic and periodontal criteria. The protocol for the routine performance of periapical radiographs requires accuracy in the positioning of the cone in the superior-inferior direction or even in the mesial-distal direction, mainly if we evaluate the radiographs for accuracy according to the Prichard criteria. These criteria do not allow
for misplacement of the radiograph cone, an element that is checked several times in different angles according to Prichard's criteria. Going beyond these criteria is included in criterion 1, which categorically prohibits the top-down displacement of the cone, and then criterion 4 strengthens criterion 1 even more, not allowing any minimal violation in the positioning of the radiograph cone. Criterion 2 and criterion 3 are in line with each other, orienting around the positioning of the cone and its movement to the left or right. This is often reflected in the coverage that the teeth make at the point of contact, which should be empty, so there are no tooth clusters.

Part of the selection of accurate radiographs, both periodontally and radiographically, helps us to examine endo lesions, perio lesions, and combined endo-perio lesions as accurately as possible. (7,12,15,18,23,25,37,43)

The presence of endo-perio lesions is one of the reasons why the tooth may go to extraction. The combination of the lesion of perio origin to pass to the endo lesion, or vice versa the endo lesion to pass to the perio lesion, leads to the combination of the bacterial flora causing the inflammation which finds a communication path between the tooth-bearing structures and the pulp structure. Depending on the area where the lesion appears, the objective and subjective complaints of the lesion presented and referred by the patient may be combined. Differential diagnosis in the appearance of objective and subjective complaints should be performed carefully, prioritizing the use of accurate periapical radiography. (2,15,24,38,42-49)

Endo-perio lesions have been subjected to various classifications, modified over time. At the moment when this classification is an integral part of a larger classification such as the classification of periodontal diseases, changes in the classification of periodontal diseases consequently pass and express changes in the classification of personalized endo-perio lesions. (12,35,37) Many authors have copyrighted their proposed endo-perio classifications. It is important that the classification of endo-perio lesions is performed on the basis of radiographic data and the transition from one subclass to another is very sensitive and specific according to apparently minimal radiographic changes of the affected structures. A significant coverage of some subclasses of one classification to a subclass of another classification is distinguished. This coverage requires even higher radiographic accuracy and precise knowledge to determine the criteria when a lesion belongs to a subclass of the classification and when this lesion passes with its characteristics to the next subclass. (15,16,27,38,39,40,43-49)

Each classification or subclass of the general classification of endo-perio lesions enables orientation on the treatment of the lesion, in the sense of which of the therapies is primary, that of the endodontic treatment of the tooth, or that of its periodontal treatment. (34,35,41)

The true combined endo-perio lesion with high vulnerability of the tooth furcation, that is, the lesion presented in the molars, has a prognosis that also leads to tooth extraction, since the vulnerability of the tooth-bearing structures is high and their renewal requires periodontal surgical procedures biasing somewhat against tooth hemisection procedures, or extraction of the affected tooth. (33,34,36)
As results expressed in figures, documented by our study, they are as follows:

- Classification of radiographs based on whether they met accuracy criteria showed that 81% of radiographs met periodontal and radiographic criteria simultaneously. 9% were perioperatively and radiologically incorrect; perio incorrect and radiologically correct were in 6% and recently both evaluation criteria were incorrect in 5% of the included cases.

- For periodontal criteria on the accuracy of radiographs: 100% did not fulfill Prichard's criterion 1, 8% did not fulfill Prichard's criterion 2, 55% did not fulfill criterion 3 and 0% was related to fulfilling criterion 4.

- The percentage of coverage in non-fulfillment of criteria 1 and 2 was 18%. The coverage percentage of the 3rd criterion and the 4th criterion was 55%. The percentage of coverage of criterion 1, 2 and 3 was simultaneously at 72%. Non-fulfillment for criterion 4 was at the value of 0%. The average percentage of coverage for the four criteria was about 73%.

- The distribution of radiographs depending on the presence of endo or perio lesions varies as follows: endo lesions were presented in 32 cases or in 38% of the radiographs; perio lesions were present in 22 cases or in 26% of the radiographs and endo-perio lesions were in 30 cases or in 36% of the radiographs included in the study.

- According to the classification Simon et al. radiographs were divided: class a 40%, class b 20% class c 7% class d 10% and class e 23%.

- According to Tobabinejad and Trope classification, endo-perio lesions were according to classes specifically: class a 60% class b 17% class c 23%.

**Conclusions**

The relatively low percentage of erroneous radiographs, both for radiographic and periodontal criteria, can also be justified as human error. The tangible percentage in sensible and visible values is when the error occurs for radiographic criteria, or when the error occurs for both radiographic and periodontal criteria.

The use of an accurate radiograph is what is important during the periodontal examination.

The main violation of the accuracy criteria of the radiographs is mostly related to the displacement of the cone in the up-down direction, which is performed in support of the routine protocol in the performance of periapical radiographs.

The values in the study showed results on the frequency of occurrence relatively the same for both endo and periodontal lesions and in cases of occurrence of the endo-perio combination.

This data confirms the fact that endo-perio lesions have the same probability of occurrence, both for endo-only lesions and for perio-only lesions.
Despite the different types of classification of endo-perio lesions, the distribution across classification classes shows the same values in equal percentages for true combined endo-perio lesions.

For other subclasses, classifications with several subclasses are more sensitive in the course and prognosis of endo-perio lesions, but difficult in determining which class this lesion belongs to.

**Declarations**

**Funding**

Not applicable.

**Conflict of interest**

The authors declare that they have no conflict of interests.

**Ethics approval**

As authors of the article, we state that there is no violation of the code of ethics during the realization of this article. This study was submitted to and approved by Albanian University Institutional Ethics Committee, date 29.06.2021, Tiranë, Albania, according to national regulations.

**Consent to participate**

Not applicable.

**Consent for publication**

Accepted.

**Availability of data and materials**

The datasets analyzed during the current study are available from the corresponding author.

As authors of the article, we declare for data transparency.

**Code availability**

Not applicable.

**Contributions**

IR collected the scientific data and wrote the manuscript. SH revised and edited the manuscript. Literature research was conducted by SH and EH. BQ and VO collected the scientific data. All authors read and approved the final manuscript.
Corresponding author

Correspondence to Ilma Robo.

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Graphs

Graphs 1 to 4 are available in the Supplementary Files section

Figures
Figure 1

Radiographs defined as periodontally and radiologically incorrect. The first four radiographs were excluded from further data processing for the effects of radiological error and the bottom 2 graphs for the effect of the Prichard criteria, namely criterion 3 and criterion 1.
Figure 2

Periapical radiographs meeting all four Prichard criteria (examples).
Figure 3

The radiographs below show examples of grade 3 endo-perio lesions, combined lesions.

Figure 4

Endodontic lesions - their radiographic appearance - clinical cases.
Figure 5

Periodontal lesions – their appearance on radiographs – clinical cases.

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- G1.png
- G2.png
- G3.png
- G4.png