Cohort Study

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Influence of clinical experience in detecting calcifications of the head and neck region on panoramic radiographs: an app-based evaluation

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Introduction: Digital panoramic radiographs (DPRs) are used in dental practice as the first diagnostic tool for the initial detection of head and neck regions soft-tissue calcifications. The aim of this study was to use a self-developed application (App) to evaluate the ability of dental students at different levels of training to examine known DPRs with different soft-tissue calcification.
Methods: A total of known 100 DPRs with ($n = 50$) and without ($n = 50$) calcification were independently evaluated by four groups: preclinical, first clinical and last clinical dental students, and dentists with less than or equal to 1 year of professional experience in the same time (15 min) and examination conditions. Unity software was used to develop the examination App, which allowed to mark areas with calcifications on the DPRs. The data were statistically analyzed between the groups (significance level: $P < 0.05$) for every location, and the detection rate was calculated as a percentage of detected calcifications.
Results: Results revealed that the overall detection rate of calcifications in all groups was 29.17%. Dentists exhibited the highest detection rate (36.46%), followed by the last- (29.69%), first- (32.29%), and preclinical (15.10%) students.
Conclusion: These findings suggest that clinical experience plays a role in the correct detection of soft-tissue calcifications in DPRs. However, deficiencies in radiological training during dental education may contribute to diagnostic errors. As these can become life-threatening risks, the results highlight the need for early training in the dental curriculum to improve diagnostic performance and minimize possible diagnostic errors.

Keywords: calcification, clinical experience, dental, education, panoramic radiography

Introduction

Many diseases can be diagnosed using digital panoramic radiographs (DPRs), and this radiographic technique is a routine diagnostic method in dentistry[1]. There is a broad consensus in the literature that DPRs play an important role in the detection of calcifications in the head and neck region because initial diagnosis is possible without any additional radiation exposure or other efforts[2,3]. Calcifications consist of calcium salts, mainly calcium phosphates, and often present as disordered mineralized deposits in physiological or pathological soft-tissue structures[4]. They can be divided into three groups: metastatic[4–6], dystrophic[4], and idiopathic calcifications[7,8].

The discovery of soft-tissue calcifications in the head and neck region may be crucial for saving a patient's life, especially for carotid artery calcifications (CAC). In such cases, dentists are advised to refer patients with undiagnosed soft-tissue calcifications for further examination to rule out any life-threatening risks[2,9]. Notably, the vast majority of CAC observed on DPRs correspond to calcified carotid plaques of varying sizes, as confirmed through ultrasound imaging[10,11]. The most common cal cifications diagnosed on DPRs in the head and neck area are CAC[12], tonsilloliths (TL)[13], calcified submandibular lymph nodes (CSL)[14], sialoliths of the submandibular gland (SSG)[15], and idiopathic osteosclerosis (IO) of the jawbone[7]. Practitioners

HIGHLIGHTS

- Our app-based study shows that clinical experience enhances the detection of soft-tissue calcifications in digital panoramic radiographs.
- The results revealed an overall detection rate of 29.17%, with dentists achieving the highest detection rate of 36.46%.
- The study underscores the need for early radiological training in the dental curriculum to improve diagnostic performance and minimize errors.

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often face the challenge of detecting soft-tissue calcifications on panoramic radiographs, as previous studies have shown[16].

However, diagnostic errors may occur when interpreting DPRs, particularly regarding soft-tissue calcifications. Using a template displaying the respective predilection sites for five types of calcifications (CAC, TL, CSL, SSG, and IO) aids their detection in daily dental practice[17]. The most important criteria in the diagnosis of calcifications are their anatomical location, distribution, number, size, and shape[18,19]. Although it has generally been noted that clinical experience plays a crucial role in the effectiveness and accuracy of diagnostic processes, diagnostic errors may originate as early as in the education of dental students owing to a lack of radiological training[20,21]. Causes may include a lack of knowledge regarding the characteristic features of abnormalities or healthy structures[22]. Consequently, diagnostic errors in dentistry are significantly underexplored in the field of patient safety[23]. Addressing dental diagnostic errors is of utmost importance for all participants in dental educational institutions to enhance ongoing efforts focused on improving the quality of dental care and early diagnosis[24]. Our dental clinic is at home in a calcareous wine-growing region. Calcifications are therefore a focus of our research group. The aim of this app-based study is to evaluate dental students' knowledge and possible early detection of soft-tissue calcifications on DPRs at different clinical and pre clinical stages of the dental curriculum. There are different options for evaluating knowledge. In this study, we decided to use an APP to examine radiological knowledge regarding the exam ination of DPRs in a retrospective cohort. For this purpose, an application (APP) was developed in which participants could diagnose and evaluate abnormalities in DPRs. The use of digital technologies in oral and maxillofacial radiology education, either alone or in combination with traditional teaching methods, has proven to be a positive development in recent years[25,26].

Methods

Study design and patient collective / data preparation

This empirical study was conducted in Austria in 2023. The study protocol was approved by the Lower Austria Ethics Review Committee (approval number GS4-EK-4/379-2016). The goal was to assess the skills to detect soft-tissue calcifications in DPRs of preclinical and clinical dental students and dentists with less than or equal to 1 year of professional experience. This type of calcification was deliberately chosen because it was an existing patient population. The intention of the study was not to filter out the exact diagnosis of the various calcifications, but rather to evaluate the students' knowledge. It should be noted that the study cannot provide more robust empirical data to support the claim that diagnostic errors associated with calcifications could be life-threatening. This study was prepared in accordance with the STROCSS 2021 criteria[27].

Panoramic radiographs can mislead physicians in the diagnosis and differential diagnosis of soft-tissue calcifications in the head and neck due to distortions, overlays, metal artifacts, and ghosting.

As soon as we were able to detect calcification there, it was referred for ultrasonography. USG is an important diagnostic tool for determining the location of soft-tissue calcifications that may be confused on two-dimensional radiographs, their relationship to adjacent structures, and defining calcifications. It can be safely used to detect soft-tissue calcifications because it provides dynamic imaging without the use of radiation or contrast media compared to other advanced imaging techniques[28].

For DPR selection, 1716 DPRs with existing cone beam computed tomography (CBCT) data were evaluated. These are the CBCTs of a well-known patient group that were recorded at the DPU between 2013 and 2022 for various reasons. Indications for radiological examination included implant planning, endodontic or orthodontic reasons, and evaluation of inflammation or anomalies.

In this study, from the collective of DPRs examined in the publication by Schreiner-Tiefenbacher *et al.*[29] only those were used for analysis in which all examiners achieved 100% of the same result. As a result, 50 DPRs with calcifications and 50 without calcifications were filtered out as a control group. In this process, only DPRs with sufficient image sharpness, contrast and without artefacts that could impair interpretation were used. In addition, all DPRs included a clear visualization of relevant structures such as the temporomandibular joints, maxillary sinuses, and salivary gland ducts, as calcifications often occur in these areas. A documented clinical history had to be available for each DPRS in order to analyze the correlation between radiological findings and clinical symptoms.

Exclusion criteria were DPRS with blurred imaging, patients younger than 50 years of age, motion artefacts or excessive exposure errors that could affect the visibility of calcifications. In addition, DPRs from patients with congenital jaw anomalies or pathological findings such as tumors that could alter the typical appearance of the anatomical structures examined were excluded, as well as DPRs with clear metal artefacts (e.g. from braces or implants) that could interfere with the diagnostic assessment of soft-tissue calcifications.

Radiographs showing reduced image and containing artifacts were excluded. Two independent maxillofacial radiology experts from different universities with more than ten years of clinical experience evaluated each patient's DPRs and CBCT scans of each patient, and any differing radiological findings were disregarded and there was no intention of reaching a consensus. In this study, 100 DPRs were selected for further examination. This patient group is already known, which is used to check the knowledge of the students and was also published in a comparative study of Schreiner-Tiefenbacher *et al.*[29] Of these, 50 DPRs with one or more soft-tissue calcifications and 50 without calcifications were evaluated. The criteria for selecting a DPR showing calcification were a localized shadow larger than 1 mm on the DPR and a confirmed finding on the CBCT[29,30]. A total of 96 calcifications were diagnosed in 50 DPRs. Of these, 63 were TL, 17 were CAC, 11 were IO, four were CSL, and one was SSG. Thirty-one patients had greater than 1 calcification (probability <1; 31%), and of these, another 11 individuals had greater than 2 calcifications (probability <2; 11%). The ratio between men and women was 1:1 with an average age of 65.3 years. All radiographs were obtained using a Dentsply Sirona Orthophos SL 3D imaging (Dentsply Sirona) unit tube voltage: 60–90 kVp; tube current: 3–16 mA. For DPR imaging, a digital cadmium-tel luride sensor was utilized, while a digital flat-panel detector was used for CBCT imaging. The active sensor area measured 160 × 160 mm. Clinical applications typically use a field of view (FOV) measuring ø5 × 5.5 cm, with radiation doses ranging from 3 to 20 μSv. All patients were positioned according to the manufacturer's instructions using a 3-point fixating system and a light device to determine the Frankfurt horizontal and mid-sagittal planes.

App development

To evaluate the partitioners' skills, an APP for assessing DPRs was programmed, specifically for the study, using the software Unity 2021.3.15 (Unity Technologies). The 100 radiographs were imported into the software Unity, and the presence of the five types of calcifications mentioned above was marked according to the predilection template used by Sutter *et al.*[17] (Fig. 1). An invisible button was placed for user input and scaled individually to regions where calcifications were detectable. By clicking on these invisible buttons, the intractability of the button was disabled, and the data were stored in a log file. The participants only had the option to select the area, but not to diagnose from different types.

To give the practitioners a comparable amount of time for each radiograph, a countdown starting from 15 s was displayed, which changed color after 15 s. Prior to each transmission of the practitioner's interaction on each radiograph, an approval button marked as "check outcome" had to be used to go to the next radiograph. If a practitioner wanted to revise the input, a "reset" button had to be used (Fig. 2). The application was installed on a Zotac ZBOX-ID82 minicomputer (ZOTAC Technology Ltd.) with a ViewSonic VX2239wm monitor with a resolution of 1920×1080 pixels (ViewSonic Europe Ltd.) used for imaging. Prior to the investigation, a standardized introduction and explanation were provided to the practitioners, and the questions were answered. The practitioners were blinded to the investigation and log files. Data were recorded in Excel (Microsoft Corp.) for evaluation. The APP did not allow any adjustments such as zooming, brightness, or contract adaptions.

Examination and evaluation

The 100 DPRs were evaluated using the application by 40 participants with different levels of knowledge and experience. The 40 participants were divided into four groups, for equivalent implementation. This meant that everyone could carry out the study on viewing monitors at a sufficient distance in a darkened room. The groups consisted of three student groups of 10 students each from a preclinical (7th semester), first clinical (9th semester), and last clinical semester (11th semester), and a group of 10 dentists with less than or equal to 1 year of professional experience. The groups were specifically selected so that the preclinical semester had not yet had a radiology lecture, the second group after the radiology passed the examination in the curriculum, 11th semester after completion of clinical training on the patient, with applied knowledge. The young dentists are graduates of different universities to add variability. Of the 40 participants, 26 were male, 13 were female, and one was diverse, with a mean age of 26 years. The evaluation was performed independently in the same standardized, dimly lit room, in the same order and time period. Prior to the investigation, a standardized introduction and explanation were provided to all practitioners. Participants were asked to diagnose and click on all abnormalities inside and outside the bony structures in the DPRs. It was specifically mentioned that teeth should not be interpreted. Patients with tooth abnormalities were excluded. Participants had a suggested time of 15 s for each DPR; however, they could restart with the current DPR after the time expired or if they missed or misdiagnosed abnormalities. Short breaks could be taken by the participants between radiographs at any time. Results were recorded and prepared in Microsoft Excel 16.52 (Microsoft Corp.) and subsequently statistically evaluated utilizing SigmaPlot 13.0 (Systat Software Inc.), using ANOVA on ranks after analyzing normal distribution between the groups and each region. The results were classified according to the type and presence of calcification.

Results

Of the 96 calcifications, 63, 17, 11, four, and one were TL, CAC, IO, CSL, and SSG, respectively. All four investigator groups combined, detected an average of ~28 calcifications (29.17%). The preclinical subgroup found 15.10% ± 10.24%, the first clinical 32.29% ± 7.96%, the last clinical 29.69% ± 6.59%, and the dentists 36.46% ± 13.14% of all calcifications (Fig. 3). Of the five types of calcifications, the most frequently detected calcifications were CSL (45.62%), IO (37.27%), SSG (30%), TL

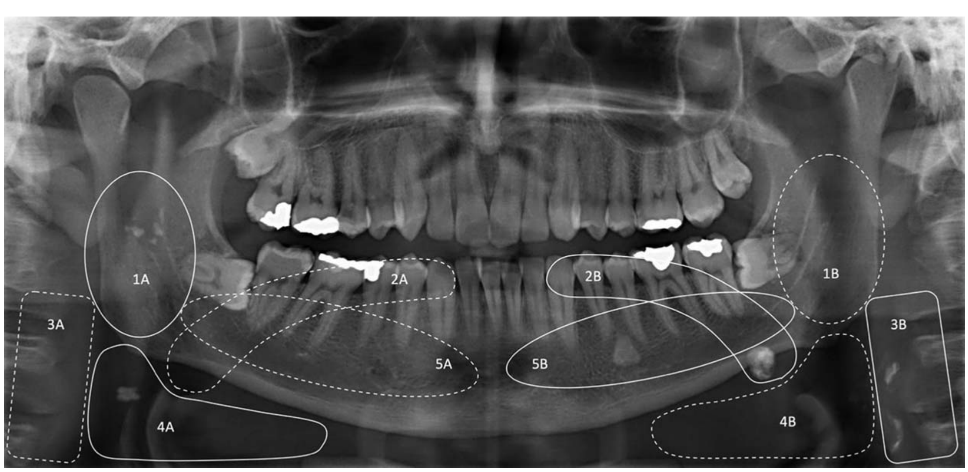

Figure 1. Panoramic radiographs template representing the predilection sites of the five examined types of calcifications: (1) TL, tonsilloliths; (2) SSG, sialoliths of the submandibular gland; (3) CAC, carotid artery calcification; (4) CSL, calcified submandibular lymph nodes; (5) IO, idiopathic osteosclerosis; A = left side, B = right side.

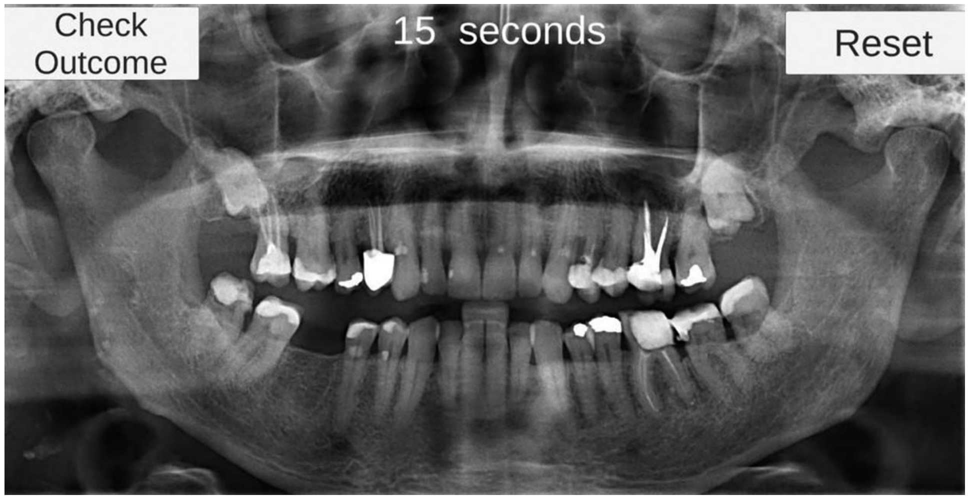

Figure 2. Layout of the programmed APP for diagnosis of the digital panoramic radiographs; note the timer at the top, the “Check Outcome” and the “Reset” button.

(28.57%), and CAC (22.21%) (Fig. 4). The results were divided into different categories. Comparisons between the individual investigator groups revealed a statistically significant difference ($P < 0.001$). In particular, the preclinical group exhibited significant differences compared with the clinical group and also demonstrated a statistically significant difference from the first clinical semester ($P < 0.001$), to the last clinical semester ($P = 0.008$), and the dentist group ($P < 0.001$) (Fig. 3). The calculation has been performed for each group separately.

Additionally, the dataset was analyzed based on the percentage of detected calcifications and subdivided into further calcification categories per investigator-subgroup (Fig. 4). The calcification categories of the detected calcifications displayed a statistically significant difference ($P < 0.001$). More specifically, significant differences were observed between calcification categories CSL and SSG ($P = 0.001$), CSL and CAC ($P = 0.008$), IO and SSG ($P = 0.004$), and IO and CAC ($P = 0.023$). All other calcification categories showed no statistically significant differences among each other ($P > 0.05$) (Fig. 5 + Table 1).

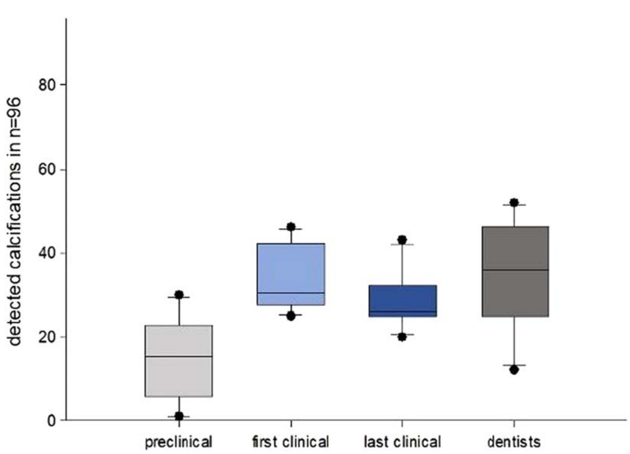

Figure 3. Result of detected calcifications in total with the reference value $n = 96$.

Within the subgroup of preclinical students, significant differences were found between the calcification categories ($P = 0.003$). In particular, the IO calcification category exhibited significant differences compared to the SSG ($P = 0.012$), CAC ($P = 0.012$), and CSL ($P = 0.040$) calcification categories and did not show significant differences with the TL calcification category ($P = 0.530$). Categories TL, CAC, CSL, and IO did not demonstrate statistically significant differences ($P > 0.05$) (Fig. 6A). The subgroup of first clinical students did not show significant differences between the calcification categories ($P = 0.114$) (Fig. 6B). Data were stored separately for each image for each investigator. For further analysis, the mean data was calculated for each region within the group and the standard deviation was calculated.

Furthermore, the subgroup of last clinical students showed statistically significant differences among the calcification categories ($P < 0.001$). Specifically, the CSL calcification category displayed a significant difference with the SSG calcification category ($P < 0.001$), but not with the other calcification categories ($P > 0.05$). Additionally, the IO and SSG calcification categories showed a significant difference ($P = 0.043$). All other calcification categories showed no statistically significant differences ($P > 0.05$) (Fig. 6C).

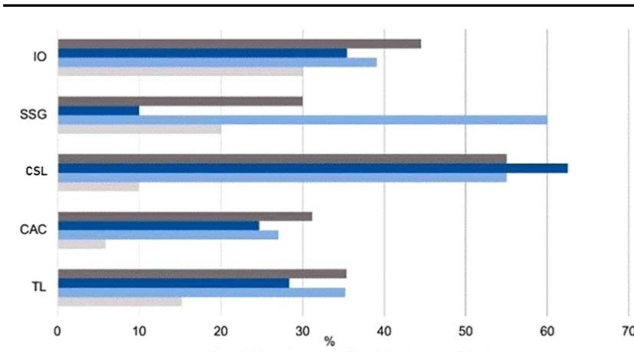

Figure 4. Result of detected predilection calcifications between the four groups in percent (dentists, last clinical, first clinical and preclinical).

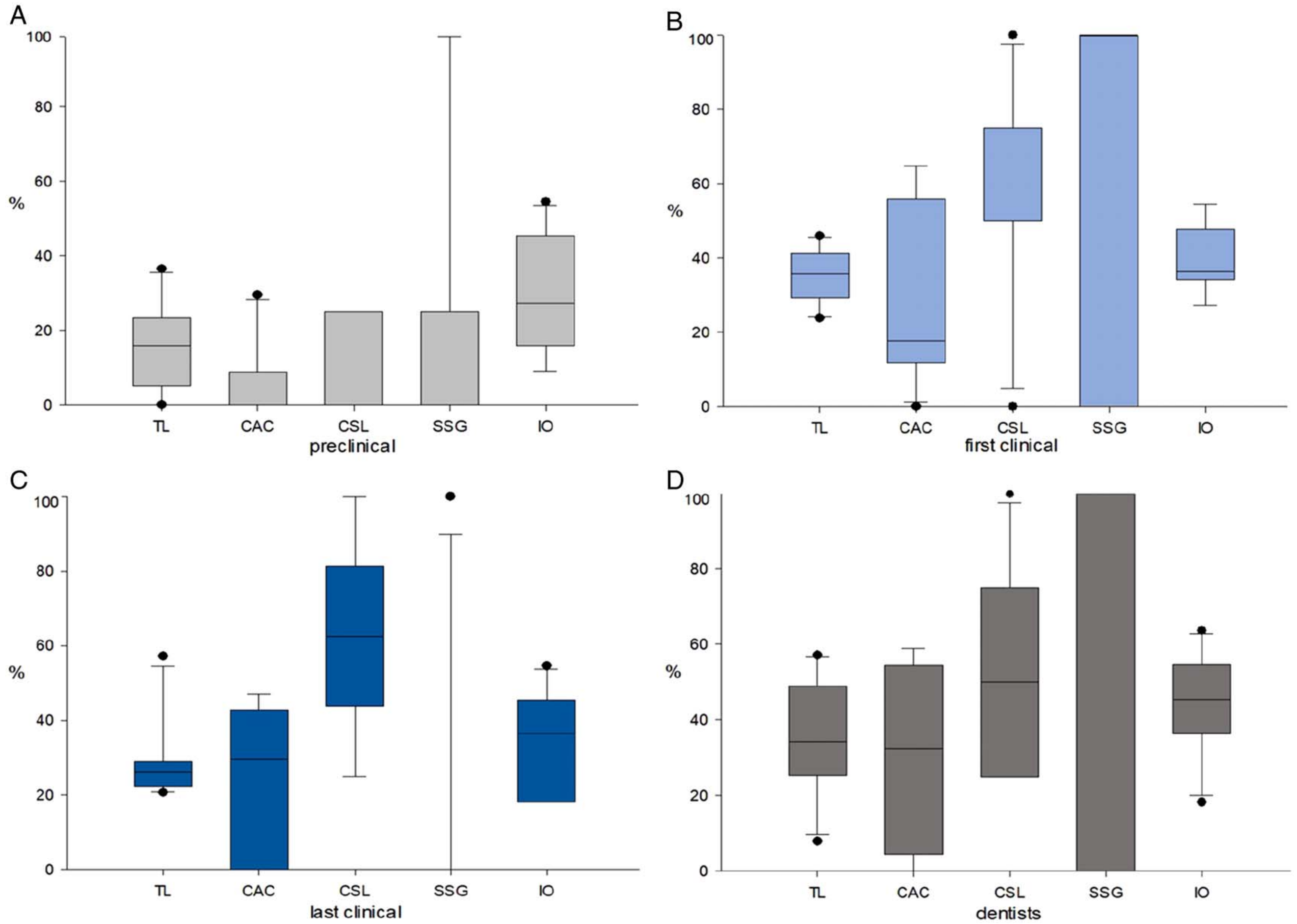

Figure 6. Results in comparison between the four investigated groups: preclinical (A), first clinical (B), last clinical (C), dentists (D) [tonsilloliths (TL); carotid artery calcifications (CAC), calcified submandibular lymph nodes (CSL); sialoliths of the submandibular gland (SSG); idiopathic osteosclerosis (IO)].

Finally, the dentist subgroup exhibited no significant differences between the calcification categories ($P = 0.167$) (Fig. 6D).

Discussion

As previous studies concluded, clinical experience may enhance correct radiologic diagnostic. Therefore, this study investigated how the examiner's clinical experience and level of education influenced the correct detection of soft-tissue calcifications on DPRs. A statistically significant difference in detecting calcifications was observed between preclinical and clinical participants, suggesting that the clinical experience of the investigators, at least in the early years of clinical work, may be a factor in diagnostic confidence. The data suggest that participants with even longer clinical experience could detect more calcifications. However, it must be considered that the last 3 years have not been beneficial for students and graduates due to the Coronavirus disease 2019, as lockdowns had restricted on-site teaching at universities. Adaptation to virtual learning potentially caused deficits in clinical skills due to limited hands-on training, social isolation, and other factors[31]. Several studies have reported concerns related to the clinical skills of dental students, including a lack of confidence[32] and reduced clinical competence[33], as skill development was generally impacted due to the suspension of clinical activities[31]. These concerns and a lack of clinical confidence in the diagnosis of DPRs may be reflected in the results presented here. In contrast, clinical experience is not the main factor for a correct diagnosis, as the lack of crucial preclinical skills, such as anatomy, plays a critical role in being able to correctly analyze DPRs. The dentists correctly identified the maximum number of calcifications compared with the other groups. However, they were still far from correctly identifying the majority of calcifications, confirming the previous assumption that diagnostic errors originate as early as undergraduate student education[21]. These results may differ in other European countries, because dental education in Europe appears to be inconsistent, although it should be comparable due to the bologna process of the European Union[34]. For example, regarding the standardization of the European dental curriculum, a recent review found that challenges remain, particularly in ensuring comparable levels of performance in important aspects, such as clinical experience[34]. Therefore, the results cannot be generalized and are limited to students within the Austrian dental curriculum. In addition, reproducibility is limited because Lower Austria is a very calcareous region, which leads to distortions in the incidences compared to other regions.

In our study, the geographical bias was not sufficiently equalised or avoided due to the use of a patient collective drawn from a single geographical location. In order to improve the generalizability of our study and the variability of the patients in the future, we would like to include study participants from different geographical regions and different countries in the study.

In addition, the statistical analysis should be expanded in further and larger-scale studies by using multivariate analyses or regression techniques that include the quality of radiological training and individual diagnostic skills as independent variables.

Another factor for the misinterpretation of DPRs could be fatigue[35], which could also have played a role in the conduct of our study, as participants had to evaluate 100 DPRs in a row with a time target of 15 s. However, short pauses and restarting of the timer were possible.

The test conditions were the same for all participants and the test was always conducted at the same time of day at 11.00 a.m. on different days of the week in order to take into account potential confounding variables such as tiredness. In the introduction before the evaluation was mentioned that pathologies of the teeth must not be considered. Attention should only be paid to conspicuous structures inside and outside the bony areas. In this way, interest was deliberately aroused in abnormalities such as calcifications. The CAC, potentially the most fatal soft-tissue calcification, was not frequently detected. It is noteworthy that only 22.21% of all CAC cases were correctly detected, indicating a strong need for action in preclinical training. To prevent such diagnostic errors, it is crucial to initiate early training in the preclinical curriculum, as there is a lack of training specifically designed to enhance students' diagnostic performance[22]. In this study, the prevalence of TL (63%), SSG (1%), CAC (17%), CSL (4%), and IO (11%) was diagnosed on radiographs. These findings were similar to those reported in the literature[17,36]. The generally high average age of the patients in this study might be reflected in the increased prevalence of each type of calcification. There was a slight discrepancy between the current study and the literature, especially for TL. However, age selection was purposefully based on previous studies showing that calcifications, as well as systemic diseases such as atherosclerosis and associated cardio- and cerebro-vascular sequelae, are more common in individuals aged older than or equal to 50 years[17,29]. Only suspected cases could be investigated in this study because only DPRs and CBCTs were available, and confirmation of calcification, for example, by Doppler imaging, was not available. Nevertheless, CBCT screening, which was additionally performed for evaluation to ensure the presence of calcification, is a reliable choice for accurately diagnosing calcifications, particularly when dealing with symptomatic cases[29,30]. The DPRs that displayed radiological artifacts or were of low quality were excluded. Furthermore, observations specifically related to dentition, endodontium, periodontium, paranasal sinuses, temporomandibular joint disease, and ossification of the stylohyoid ligament were not recorded. Consequently, only radiopacities associated with calcifications were included in the analysis, avoiding false-positive results. One other factor reflected the results is the limitation of the diagnostic options given to the practitioners. Brightness and contrast adjustments influence the radiographic detection of soft-tissue calcification. However, in this study we were interested in the interpretability of DPRs without further imaging enhancement[37].

Well-educated dentists should be properly trained in the anatomy of the head and neck. They must be able to thoroughly scan the respective areas of DPRs to detect any suspicious concretions. If indicated, patients should be referred to a specialist for further clarification and timely medical treatment[36–39]. Therefore, it is useful for dentists to refresh and improve their understanding of the anatomy of the head and neck structures and potential sites of calcification[39]. Digital technologies have become an important part of teaching and learning in higher education, including dental education[40]. Therefore, it makes sense to use an application to assess the radiological skills of dental students.

The introduction of the app in dental programmes requires a suitable technical infrastructure and possibly training for teachers and students. It is important to regularly gather user feedback to optimize the app and ensure that it meets the pedagogical objectives. Challenges could lie in the acceptance of the new technology, which is why supportive measures are essential. Despite these challenges, the app has the potential to revolutionize dental education by promoting personalized learning and facilitating access to practical exercises. As the app is designed for Windows and could even run on IOS as well, the implementation is easy to achieve. The app will continue to be developed and to improve its usability and diagnostic accuracy, the integration of functions such as image enhancement tools such as zoom, brightness and contrast settings will be integrated. Since a systematic review found that e-learning methods are more effective than traditional learning methods in oral and maxillofacial radiology[25], it would be useful to make the APP available for educational purposes, as well as investigating training performance in future studies. Finally, it has already been noted that integrating artificial intelligence effectively enhances the process of diagnosing soft-tissue calcifications, particularly when identifying CAC[41].

The app-based training could be gradually integrated into the dental curriculum, starting as a complementary tool in the preclinical phase to develop basic radiological skills. It should be used in combination with traditional teaching methods so that students acquire both theoretical knowledge and practical skills. In addition, the app could be used as a self-testing tool and for formative feedback, with modules tailored to different learning levels. To evaluate the effectiveness of app-based training compared to traditional methods, randomised controlled trials that measure learning outcomes, diagnostic accuracy and long-term impact on clinical practice would be useful. In addition, qualitative methods such as feedback from students and teachers as well as long-term studies that follow graduates could be used to comprehensively assess the benefits and challenges of app-based training.

In addition, the studies are to be conducted over a longer period of time. The graduates and study participants should continue to be followed and reassessed after a longer period of time. In this way, the influence of early radiological training on the error rate in clinical practice could be evaluated. In the future, we plan to include study participants from universities in different geographical regions and different countries in order to improve the generalizability of the study.

Conclusion

The results revealed that there was a slight correlation between the duration of the study and practical experience in radiological assessment reliability concerning the detection of calcifications on

DPRs. Furthermore, dental students and dentists lack anatomical knowledge of soft-tissue calcifications in the head and neck region. The study indicates that the causes may lie in the lack of clinical experience, and in the radiological training of dental students. Within the limitations of this study, it can therefore be concluded that it is of utmost importance to enhance the detection of incidental findings of calcifications and integrate it uniformly into the dental curriculum during radiological training. Awareness of such pathologies with the help of theoretical and practical exercises should be raised to ensure that all dental students acquire the essential skills before they begin treating patients.

The programmed APP can serve as a tool to verify radiological knowledge regarding the examination of DPRs. Further development of the APP based on the DPR template as a learning tool might help students and dentists improve their deficits and clinical competence. Finally, further research and interventions are required to address diagnostic errors in dental radiology education and improve the quality of dental care.

For further research in this area, contact has already been made with various Austrian universities in order to include different geographical regions. The app has also already been further developed and is to be established alongside teaching in the long term. Furthermore, future areas of research could include studies on the effectiveness of different teaching methods, integration of new technologies into training and long-term follow-up of graduates to investigate the impact on error rates in clinical practice.

Ethical approval

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. The study protocol was approved by the Ethics Committee for the Province of Lower Austria (GS1-EK-4/379-2016). Informed consent was obtained from all individual participants included in the study.

Consent

The patients received a thorough explanation of this report and gave oral and written informed consent to be included in this study as well as for publication of anonymous data and pictures. A copy of the written consent is available for review on request.

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Author contribution

All authors contributed substantially to the work reported. Conceptualization: B.S., P.G., C.S., and D.T.; Methodology: B.S., P.G., and U.D.; Validation: P.B. and F.P.; Collecting data and Formal analysis: U.D., D.S., and C.S.; Writing original draft preparation: B.S. and U.D.; Statistics: D.S.; Writing review and editing: D.T. and C.S. All authors have read and agreed to the published version of the manuscript.

Conflicts of interest disclosure

The authors declare no conflict of interest.

Research registration unique identifying number (UIN)

Not applicable.

Guarantor

Dritan Turhani.

Data availability statement

The datasets generated and analyzed during the current study are available upon reasonable request. Interested researchers can contact the corresponding author for access to the data, subject to institutional and ethical guidelines.

Provenance and peer review

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