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Email : editorijhess@gmail.com

The Role Of Periapical Radiography In Identifying Channel Configurations Type II *Vertucci* Root In The First Premolar Tooth Of The Maxim

Radetyo Bhumyang Pandu Wirayudha[1)*], Nilasary Rochmanita Suparno[2)], Aditya Varenka Putra Niardhy[3)], Cahyani Cahyani[4)]
[1,2,3,4)] Faculty of Dentistry, University of Muhammadiyah Surakarta, Indonesia

*Corresponding Author
Email : j530235034@student.ums.ac.id

Abstract

The first premolar maxillary has a complex diversity of root canal configurations. Identification of the proper root canal configuration greatly determines the success of endodontic treatment. Periapical radiography remains an easily accessible and useful examination to detect the possibility of more than one root canal through radiograph retrieval with the principle of Same Lingual Opposite Buccal, i.e. horizontal angulation changes and canal shadow variation analysis. To report the role of periapical radiography in identifying the configuration of the Vertucci root canal type II in the first premolar of the maxillary and its implications for endodontic management. A 39-year-old male came in with a complaint of cavities in the first premolar tooth of the left maxillary (Tooth 24). Initial periapical radiographs show the suspicion of the presence of more than one root canal. Taking radiographs with angulation variations helps to clarify the relationship of the root canal, which appears to be separate in the coronal and middle part of the root and then merge before reaching the apex, according to the Vertucci type II configuration. The radiography findings were used as a basis for determining treatment strategies and were confirmed on postoperative radiographs. Periapical radiography with angulation variations and SLOB principles remains valuable in detecting type II Vertucci configurations and aiding in the planning and implementation of more accurate root canal treatments.

Keywords: Periapical Radiography; First Premolar Maxilla; Vertucci Type II; Root Channel Configuration; Root Canal Treatment; SLOB.

INTRODUCTION

The success of root canal treatment is largely determined by the accuracy of the diagnosis, especially in recognizing the entire root canal system. If there is an unidentified channel, the area will not be adequately instrumented or filled so that microorganisms can remain in the root canal. This condition is often the cause of persistent infections and leads to treatment failure (Ahmed, 2015; Sarsam et al., 2025).

The first premolar of the maxilla, including a tooth, often poses a clinical challenge because the anatomical variation of the roots and root canals is quite large. In some cases, the two channels in the coronal section will join before reaching the apex according to the Vertucci type II configuration (Puspita Ayu & Artiningsih, n.d.). Clinically, this state is not always easy to recognize because the root canal orifice can be seen singularly when cavitite access is made. If one of the canal pathways is not found, part of the root canal system may be missed during the instrumentation procedure, increasing the likelihood of treatment failure (Ahmed et al., 2017; Olczak et al., 2022). Therefore, supporting examinations that are able to help visualize the anatomy of the roots have an important role before action is taken (Ahmed, 2015; Sarsam et al., 2025).

Radiographic examination is one of the important examinations in determining diagnosis, case identification, and treatment planning. Periapical radiography is one of the most commonly used types of radiography because it is easily accessible, relatively low cost, and has good ability to describe the anatomy of periapical roots and tissues (Ahmed, 2015; Suparno et al., 2024). Nonetheless, two-dimensional radiography has limitations, mainly due to the overlap of anatomical structures and its inability to display direct bucholingual relationships. As a result, the configuration of multiple channels is not always apparent when the radiography is taken from only one direction of projection (Ahmed, 2015; Song et al., 2017).

Cone-beam computed tomography (CBCT) examination can provide more accurate three-dimensional information about root morphology. However, its use is not always the first choice because it must consider the availability of the tool, cost, and radiation exposure to the patient according to the ALADAIP (As Low as Diagnostically Acceptable being Indication-Oriented and Patient-Specific) principle. With these considerations in mind, periapical radiography remains a rational initial examination as long as its interpretation is carried out optimally (Keerthana et al., 2021; Sarsam et al., 2025).

One of the efforts to improve the diagnostic value of periapical radiography is to make horizontal angulation changes during the image. The difference in the direction of the radiation will cause a shift in the shadow of the canal on the radiograph or known as the parallax technique, so that the relative position of the canal can be analyzed using the Same Lingual Opposite Buccal (SLOB) principle. This principle helps to distinguish overlapping channels in standard projections and makes it easier to identify root channel confluences. This case report aims to demonstrate the role of periapical radiography with angulation variation in identifying the configuration of Vertucci root canal type II in the first premolar of the maxillary and its association with clinical decision-making (Schneider et al., 2025).

RESEARCH METHODS

Study Design

This study employed a descriptive case report design to describe the role of periapical radiography with horizontal angulation variation in identifying Vertucci Type II root canal configuration in a maxillary first premolar. The report focused on the diagnostic process, radiographic interpretation, treatment procedures, and clinical outcomes of a single patient undergoing endodontic treatment.

Case Selection and Clinical Examination

The subject was a 39-year-old male patient who attended the Dental and Oral Hospital of Soelastri, Surakarta, with a chief complaint of a carious maxillary left first premolar. Clinical examination included extraoral and intraoral assessments, percussion test, palpation test, probing examination, and thermal vitality testing. Supporting examination was performed using periapical radiography to establish the diagnosis and treatment plan.

Radiographic Assessment

Periapical radiographs were obtained using standard projection techniques to evaluate tooth structure, root canal morphology, and periapical conditions. Additional periapical radiographs with horizontal angulation variation were taken during treatment to improve visualization of the root canal system. The Same Lingual Opposite Buccal (SLOB) principle was applied to analyze the positional relationship between root canals and to identify the presence of canal convergence before the apical region.

Endodontic Procedure

Root canal treatment was performed under rubber dam isolation. Access cavity preparation was followed by canal exploration using endodontic instruments. Radiographic examinations were conducted during canal negotiation and working length assessment to confirm canal configuration. Canal preparation and obturation were completed according to standard endodontic procedures. Post-obturation periapical radiographs were subsequently obtained to evaluate the quality of root canal filling and verify the final root canal configuration.

Data Analysis

Data were analyzed descriptively by comparing clinical findings with radiographic observations obtained from different horizontal angulations. Interpretation of radiographic images focused on identifying the presence of separate canals, canal convergence, and the final root canal

configuration according to the Vertucci classification system. The findings were then discussed based on relevant endodontic and dental radiology literature.

RESULTS AND DISCUSSION

Case Reports

A 39-year-old man came to RSGM Soelastri Surakarta with a complaint of the first premolar tooth left of the upper jaw with a hole, the complaint was felt since 3 years ago, there was no pain and had never been treated before. In terms of dental hygiene, patients stated that they brush their teeth twice a day.

Extraoral examination was carried out and showed the results of the absence of abnormalities, on the intraoral examination shown in (Figure 1) it was found that there was a cavity with the depth of pulp in tooth 24 in the occlusal part which extended to the messal, distal, buccal, and lingual parts. An objective examination was also carried out and the results of percussion (-), palpation (-), sonding (-), thermal tests were carried out and the patient did not feel any stimulus.

Figure 1.Condition Dental Clinic 24

Furthermore, a periapical radiograph examination was carried out to be a supporting examination in order to establish the diagnosis, the results of the radiographic examination in figure 2 showed that at the crown of tooth 24 there was radiolusion that reached the pulp chamber, in the root canal of the cervical third to the middle third there were two root canals, in the apical third there was a union of the root canal. The condition of the periodontal ligament is dilated and the dura lamina is severed in the apical third of the tooth.

Figure 2 Dental Smoothing Radiography 24

Subjective, objective, and supporting examinations which are radiographic examinations can determine the diagnosis of the above case which is necrosis of the dental pulp 24. After the determination of the diagnosis, it is followed by the determination of a treatment plan, namely multi-visit root canal treatment and crown jacket.

The treatment plan and the condition of the teeth as well as the complications that may occur are informed to the patient. The patient understands and agrees to the treatment to be carried out and signs an informed consent.

Governance

Treatment is carried out by insulation using rubber dam, then cavity access is made in 24th gear, the opening of access is carried out carefully to allow optimal visualization of the pulp chamber base. Initial exploration was carried out using endodontic instruments and radiographic examination was also carried out to show exactly the configuration of the two root canals.

Figure 3. Overview *of the Archives* on Periapical Radiography

The results of the radiographic image (Figure 3) show that the instrument is on a different path in the coronal and middle third of the root and there is a narrowing in the apical third of the root canal.

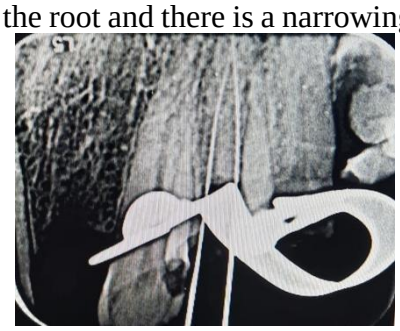

Figure 4 *Description of File Instructions* or Periapical Radiography Using the SLOB Principle

To evaluate relationship between the two canals more clearly, additional radiographic retrieval was carried out with changes in horizontal angulation using SLOB (Same Lingual Opposite Buccal) As seen in Figure 4. This technique is done by comparing two radiographs taken at different angles to see the shift in the shadow of the instrument. The results of the radiographic interpretation showed that the two canals approached each other and merged before reaching the apex, according to the Vertucci type II configuration. The radiographic information is then used as a guide during the preparation stage to ensure that both canal pathways remain instrumented according to their anatomical direction.

Figure 5. Radiographic Picture of Dental Obturation

After the procedure of preparation and filling of the duct is completed, a periapical radiography is performed to evaluate the quality of the filling while confirming the relationship of the two canals. In the results of the radiographic image (Figure 5), it can be seen that the filler follows two separate paths in the coronal and middle part of the root, then fuses before reaching the apex. The image corresponds to the Vertucci type II configuration and supports previous radiographic interpretations of the confluence of channels. Thus, the post-obturation radiography not only serves as a documentation of treatment results, but also as a final verification of the radiological diagnosis that has been established. The patient is then planned to receive post-endodontic restoration to restore dental function.

Discussion

The use of periapical radiography in this case serves as a key basis for assessing the anatomy of the roots and guiding decision-making in endodontic care. Periapical radiography is still the most widely used imaging modality in daily practice because it is able to provide a fast, economical, and easily accessible picture of tooth structure and periapical tissue (Wu et al., 2020). In this case, the initial radiography provided information about the presence of two root canals in the cervical third to the middle of the root that then appeared to fuse in the apical part. This information is the basis for establishing a diagnosis and determining an appropriate treatment plan.

Nonetheless, periapical radiography has limitations because it only produces a two-dimensional picture of a three-dimensional structure. As a result, superimposition or overlapping anatomical structures can cause certain details to be difficult to observe accurately (Ahmed, 2015). In the case of multiple root canals, this condition often poses difficulties in distinguishing whether a radiographic image shows one root canal or more than one overlapping channel. Therefore, radiographic interpretation needs to be carried out carefully taking into account the possibility of anatomical variations of the root canal.

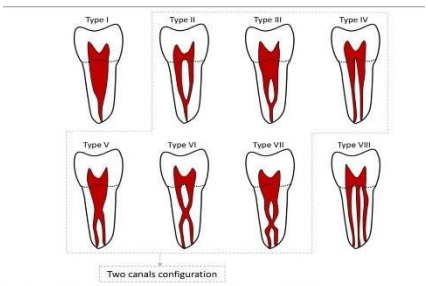

Figure 6. Vertucci Classification *12*

As a reference for the interpretation of the anatomy of the root canal, the Vertucci classification is still the most widely used system in the field of endodontics. This classification describes eight main patterns of root canal configuration based on the relationship between the number of channels in orifices and apexs (Ahmed et al., 2017). In the Vertucci type II configuration (2–1), there are two channels that start separately at the coronal section and then merge into one before reaching the apex.

This configuration is quite often found in the first premolar of the maxillary and has important clinical implications because both canal pathways must remain adequately found, cleaned, formed, and obturated to achieve treatment success (Olczak et al., 2022).

In this case, identification of the type II Vertucci configuration is carried out through a combination of periapical radiography with horizontal angulation variations. This technique is used to overcome the limitations of two-dimensional radiography in displaying the spatial relationships between root canals. When the radiography is taken from different angles, the shadow of the canal will shift so that the relationships between the channels can be observed more clearly. This approach allows operators to distinguish between completely separate channels and images that only appear separate due to radiographic projection.

The application of the Same Lingual Opposite Buccal (SLOB) principle has an important role in the identification process. The SLOB principle states that objects on the lingual side will move in the direction of displacement of the X-ray tube, while objects on the buccal side will move in the opposite direction (Mallya & Lam, 2018). By comparing two radiographs taken using different angulations, the relative positions of the two canals can be analyzed more accurately. In this case, the results of the interpretation show that the two channels that previously appeared to be separate in the coronal and middle part of the root are getting closer and closer until they join before reaching the apex. The findings confirm the existence of the Vertucci type II configuration and form the basis for the implementation of root canal preparation.

These findings are in line with the research of Schneider et al. (2025) which showed that changes in horizontal angulation are able to improve the ability of periapical radiography to detect two separate root canals in the first premolar of the maxilla. Angulation variations help reduce the superimposition of anatomical structures so that information about the direction, branching, and confluence of the root canal can be observed more clearly. Therefore, periapical radiography with angulation variations still has high diagnostic value in clinical practice, especially when three-dimensional imaging facilities are not yet available.

Although cone-beam computed tomography (CBCT) is capable of providing a more detailed and accurate three-dimensional visualization in detecting complex root canal morphology (Keerthana et al., 2021; Song et al., 2017), its use is not always necessary in every case. The selection of imaging modalities should take into account the ALADAIP principle which emphasizes the use of radiation as low as possible according to the patient's diagnostic needs (Sarsam et al., 2025). In this case, the required diagnostic information has been obtained through periapical radiography with angulation variations so that the use of CBCT is not the main indication.

The post-obturasis radiograph provides final confirmation of the results of the previous interpretation. It can be seen that the filler follows two separate channel paths in the coronal and mid-root sections, then fuses into one path in the apical section. The image shows that both channels were successfully instrumented and obtuated according to the actual anatomical configuration. These results also confirm that proper radiographic interpretation contributes directly to the success of endodontic care because it allows the entire root canal system to be treated thoroughly (Ahmed, 2015; Sarsam et al., 2025).

Overall, this case shows that periapical radiography with horizontal angulation variations is still an effective method for identifying multiple root canal configurations in the first premolar of the maxilla. Despite its limitations as two-dimensional imaging, the application of proper interpretation techniques as well as the use of SLOB principles can improve diagnostic accuracy and aid in more informed clinical decision-making in endodontic care.

CONCLUSIONS

Periapical radiography with horizontal angulation variations has an important role in the identification of the Vertucci root canal type II configuration in the first premolar of the maxilla. Through the application of the principle of Same Lingual Opposite Buccal (SLOB), the relationship between the two root canals can be observed more clearly so that the presence of canal confluences before the apecs can be accurately identified.

This case shows that periapical radiography remains of high diagnostic value in detecting anatomical variations of the root canal, especially when three-dimensional examinations such as CBCT are not yet available or have not become a major indication. Proper radiographic interpretation can support diagnosis enforcement, treatment planning, and improve the overall success of root canal treatment.

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