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UTILISING RADIOLOGY IN ENDODONTICS FOR ACCURATE DIAGNOSES AND TREATMENT

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INTRODUCTION

Radiography has revolutionized the field of Endodontics, offering a window into the intricate anatomy of dental structures that was once invisible to the naked eye. The historical milestones set by pioneers like Dr. Otto Walkhoff and Dr. Edmund Kells laid the groundwork for the sophisticated diagnostic techniques we rely on today. Periapical radiographs have become the cornerstone of endodontic diagnostics, allowing for detailed examination of the periapical region of the tooth. Bitewing radiographs complement this by providing a clear view of the interproximal areas, crucial for detecting caries and assessing the extent of restorative work needed. The use of occlusal and lateral cephalometric radiographs extends the diagnostic capabilities further, especially in cases of trauma where detailed visualization of fractures is essential. The advent of cone-beam computed tomography (CBCT) has been a game-changer, offering three-dimensional views that enhance the clinician's ability to diagnose, plan, and execute endodontic procedures with unprecedented precision. CBCT's ability to provide a comprehensive 3D assessment of oral structures makes it an invaluable tool in the diagnosis of complex cases, such as those involving the detection of vertical root fractures or the assessment of the extent of periapical lesions. The integration of digital imaging into endodontic practice has not only improved diagnostic accuracy but also patient outcomes. Digital periapical radiographs and CBCT imaging allow for a minimally invasive approach, reducing patient exposure to radiation and enhancing the overall treatment experience. As technology continues to advance, the potential for even more precise and efficient endodontic care becomes apparent, promising a future where the health and preservation of natural dentition are more achievable than ever. This article serves as a testament to the evolution of endodontic radiology and a guide to its current best practices, ensuring that practitioners are well-equipped to harness these technologies for the benefit of their patients.

PERIAPICAL RADIOGRAPHS

Periapical radiographs, a cornerstone of endodontic diagnostics, offer a two-dimensional glimpse into the complex three-dimensional anatomy of dental structures. Since their inception, they have revolutionized the field of endodontics, providing critical insights that guide practitioners in diagnosis and treatment. The transition from conventional film to digital radiography marked a significant leap forward, introducing advantages such as reduced radiation exposure, immediate image processing, and enhanced diagnostic capabilities through digital manipulation of images. The advent of digital radiography systems like RadioVisioGraphy has been particularly transformative. These systems not only streamline the imaging process but also offer a suite of tools for image enhancement, such as contrast adjustment, magnification, and the application of pseudo colors, which can

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aid in the interpretation of complex cases. The ability to digitally measure root lengths and curvature angles with precision further underscores the value of these advancements in endodontic care. Despite these technological strides, the inherent limitations of periapical radiographs cannot be overlooked. The two-dimensional nature of these images introduces challenges such as geometric distortions and anatomic superimpositions, which can obscure the true extent of pathology or the detailed anatomy of root canal systems. The inability to capture buccolingual dimensions and differentiate between various tissue types highlights the need for complementary diagnostic modalities. In response to these limitations, the field of endodontics has seen the integration of three-dimensional imaging techniques, such as Cone Beam Computed Tomography (CBCT). CBCT offers a more comprehensive view of dental and surrounding structures, allowing for a more accurate assessment of complex anatomies and pathologies. While CBCT does not replace the need for periapical radiographs, it serves as a valuable adjunct in cases where two-dimensional imaging falls short. As endodontic practice continues to evolve, the role of periapical radiography remains pivotal. Ongoing research and development are likely to yield further enhancements in digital imaging technologies, potentially mitigating some of the current limitations. The future of endodontic radiography promises to bring even greater precision and diagnostic power, ultimately improving patient outcomes and the predictability of endodontic therapies.

PARALLELING AND BISECTING TECHNIQUES

The synergy of traditional radiographic techniques with emerging technologies will continue to shape the landscape of endodontic diagnostics, ensuring that practitioners are equipped with the best tools to make informed clinical decisions. In the field of dental radiography, the paralleling technique is highly regarded for its ability to produce images with minimal geometric distortion, making it a preferred method for endodontic periapical radiographs. This technique's reproducibility is particularly advantageous for monitoring changes over time, as it allows for consistent comparisons between sequential radiographs. The process involves positioning a sensor parallel to the tooth's long axis and taking radiographs perpendicular to the sensor's surface. To achieve precise alignment, specialized holding devices are employed, ensuring the sensor is accurately positioned in relation to the radiograph tube. When working with the maxilla, the sensor is often placed at the height of the palatal vault's midline, while in the mandible, it necessitates displacing the tongue towards the midline. However, patient-specific factors such as limited mouth opening, a pronounced gag reflex, or intolerance to the sensor may necessitate adjustments to this technique. On the other hand, the bisecting angle technique, which does not require holding devices, involves radiographs passing perpendicular to the bisector of the angle formed by the tooth's long axis and the sensor. This method is less reliable for achieving geometric accuracy in conventional periapical and bitewing radiography due to the common occurrence of anatomical distortions. The use of rectangular collimation, which enhances geometric sharpness and contrast, is challenging with this technique, contrasting with the extension cone paralleling methods that are compatible with such collimation. Despite these challenges, when executed with precision, the bisecting angle technique can yield images with only minimal distortion of tooth length. However, the overlapping of anatomical structures, such as the zygomatic process of the maxilla over the root apices of molar teeth, can complicate image interpretation due to the characteristic radiopacity it produces. These nuances highlight the importance of technique selection and adaptation in dental radiography to ensure accurate diagnosis and treatment planning.

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ADJUSTMENTS IN VERTICAL AND HORIZONTAL ANGULATION

The Same Lingual Opposite Buccal (SLOB) rule is an essential concept in dental radiography, particularly useful in endodontic diagnostics. It is a method employed to discern the three-dimensional location of an object within the tooth structure or surrounding alveolar bone by manipulating the horizontal angulation of the X-ray beam. The technique involves taking a standard orthoradial periapical radiograph at zero degrees of horizontal angulation, followed by additional radiographs with mesial or distal shifts. These shifts help to differentiate between objects that may be superimposed in the orthoradial view, such as roots, canals, dental instruments, or foreign bodies. When interpreting these images, the SLOB rule dictates that an object closer to the buccal side of the dental arch will appear to move in the opposite direction of the X-ray tube's movement when compared to the original orthoradial image. Conversely, an object closer to the lingual side will seem to move in the same direction as the tube's movement. This principle is particularly helpful when determining the position of canals during root canal therapy or when assessing the presence of foreign objects or lesions that may be obscured in a standard radiograph. In cases of dental trauma, the SLOB rule is complemented by adjustments in both vertical and horizontal angulations to uncover fractures that might be hidden by overlapping structures. A slight change in the horizontal angle, typically between 10 to 15 degrees from the orthoradial position, can reveal vertical fractures of the crown, root, or alveolar bone. Similarly, altering the vertical angulation can help in detecting horizontal fractures. These techniques are vital for accurate diagnosis and subsequent treatment planning, ensuring that practitioners can provide the best possible care for their patients. The SLOB rule, along with careful angulation adjustments, exemplifies the precision and attention to detail required in dental radiography.

MASTERPOINT/MASTER APICAL FILE

In endodontic procedures, precision is paramount, particularly when it comes to the critical phase of root canal filling. The process begins with meticulous canal instrumentation, shaping the canals to receive the filling material effectively. This is followed by determining the working length, which is the distance from a coronal reference point to the point at which canal preparation and obturation should terminate. It is essential to confirm this length radiographically to ensure accuracy. A radiograph is taken with the master apical file (MAF) or gutta-percha points in place, extending to the predetermined working length. This radiographic verification serves multiple purposes: it confirms the correct working length, detects any procedural errors such as canal transportation or perforations, and helps prevent under- or over-filling of the root canal system. The size of the master cone used for obturation typically matches the MAF, but adjustments may be necessary to achieve a snug fit within the canal. In certain cases, additional radiographic steps are warranted to monitor the progression of obturation, especially when using specific filling techniques. For instance, the lateral compaction technique, which involves the use of a sealer and accessory cones alongside the master cone, requires a mid-obturation radiograph to confirm correct placement. Similarly, warm vertical compaction techniques necessitate a radiograph during the downpack stage to verify the apical seal before backfilling the canal. Adhering to these protocols ensures the integrity of the endodontic treatment, aiming to maintain the health of the periapical tissues and prevent reinfection. The final radiograph, taken after obturation, serves as a record of the treatment performed and a baseline for future assessments. It is a

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testament to the clinician's skill and attention to detail, reflecting the meticulous care taken throughout the procedure. By following these guidelines, endodontists can provide reliable, high-quality care that stands the test of time.

BITEWING RADIOGRAPHS

Bitewing radiographs are an essential diagnostic tool in dentistry, particularly within the field of Endodontics. These 2D radiographs are adept at capturing the crowns of teeth in either the left or right maxillary and mandibular sextants, providing a clear view of the upper and lower teeth in one image. They are especially valuable for examining the proximal surfaces of the teeth, which are the areas adjacent to neighboring teeth. This is crucial for detecting interproximal caries, which are cavities that occur between teeth and are not easily visible to the naked eye or on other types of radiographs. In addition to caries detection, bitewing radiographs are instrumental in assessing coronal leakage, which refers to the infiltration of bacteria and contaminants into the tooth through imperfections in dental restorations or fillings. This can lead to further decay and infection if not promptly addressed. Furthermore, these radiographs assist dental professionals in evaluating the restorability of a tooth. By providing a detailed image of the existing dental restorations and the remaining tooth structure, practitioners can determine the viability of performing additional restorative procedures or if alternative treatments are necessary. The clarity and detail offered by bitewing radiographs also contribute to a more comprehensive understanding of the patient's oral health. They can reveal early signs of bone loss due to periodontal disease, highlight developmental abnormalities, and help in the planning of orthodontic treatments. Moreover, they are a critical component in the creation of a baseline record against which future changes in dental health can be measured. While periapical radiographs are valuable for their ability to show the entire tooth from crown to root, bitewing radiographs provide a unique perspective that is particularly beneficial for viewing the coronal aspects of the teeth. This makes them an indispensable part of routine dental examinations and a key resource for endodontists and general dentists alike in the diagnosis, treatment planning, and management of dental conditions. The use of bitewing radiographs in Endodontics underscores the importance of precise imaging in dental medicine. As technology advances, the quality and capabilities of these radiographic tools continue to evolve, offering even greater precision and diagnostic potential. This ongoing development ensures that dental professionals are equipped with the best possible resources to maintain and improve oral health, emphasizing the critical role of bitewing radiographs in modern dentistry.

REFERENCES

1. Benz C, Mouyen F. Evaluation of the new RadioVisioGraphy system image quality. Oral Surg Oral Med Oral Pathol 1991;72:627–31.
2. Parks ET, Williamson GF. Digital radiography: an overview. J Contemp Dent Pract 2002;15:23–39.
3. Bender IB, Seltzer S. Roentgenographic and direct observation of experimental lesions in bone: I. 1961. J Endod 2003;29:702–6 [discussion 701].
4. Nair PN. New perspectives on radicular cysts: do they heal? Int Endod J 1998;31: 155–60.

ISSN: 2692-5206
AMERICAN ACADEMIC PUBLISHER
INTERNATIONAL JOURNAL OF MEDICAL SCIENCES

5. Gro¨ndahl HG, Huumonen S. Radiographic manifestations of periapical inflammatory lesions. Endod Top 2004;8:55–67.
6. Forsberg J. A comparison of the paralleling and bisecting-angle radiographic techniques in endodontics. Int Endod J 1987;20:177–82.
7. Fava LR, Dummer PM. Periapical radiographic techniques during endodontic diagnosis and treatment. Int Endod J 1997;30:250–61.
8. Hoe KH, Lee SS, Jeon IS, et al. Quantitative analysis of errors in alveolar crest level caused by discrepant projection geometry in digital subtraction radiography: an in vivo study. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2005;100:750–5.
9. Forsberg J, Halse A. Radiographic simulation of a periapical lesion comparing the paralleling and the bisecting-angle techniques. Int Endod J 1994;27:133–8.
10. Kaffe I, Gratt BM. Variations in the radiographic interpretation of the periapical dental region. J Endod 1988;14:330-5.
11. Van Aken J, Verhoeven JW. Factors influencing the design of aiming devices for intraoral radiography and their practical application. Oral Surg Oral Med Oral Pathol 1979;47:378–88.
12. Becconsall-Ryan K, Tong D, Love RM. Radiolucent inflammatory jaw lesions: a twenty-year analysis. Int Endod J 2010;43:859–65.
13. Cotti E, Campisi G. Advanced radiographic techniques for the detection of lesions in bone. Endod Top 2004;7:52–72.
14. Flores MT, Andersson L, Andreasen JO, et al, International Association of Dental Traumatology. Guidelines for the management of traumatic dental injuries. I. Fractures and luxations of permanent teeth. Dent Traumatol 2007;23:66–71.
15. Friedman S. Prognosis of initial endodontic therapy. Endod Top 2002;2:59–98.
16. Patel S, Dawood A, Whaites E, et al. New dimensions in endodontic imaging: part 1. Conventional and alternative radiographic systems. Int Endod J 2009;42: 447–62.
17. Rudolph DJ, White SC. Film-holding instruments for intraoral subtraction radiography. Oral Surg Oral Med Oral Pathol 1988;65:767–72.
18. Patel S, Durack C, Abella F, et al. Cone beam computed tomography in Endodontics - a review. Int Endod J 2015;48:3–15.
19. Scarfe WC, Farman AG, Sukovic P. Clinical applications of cone-beam computed tomography in dental practice. J Can Dent Assoc 2006;72:75–80.
20. Setzer FC, Hinckley N, Kohli MR, et al. A survey of CBCT use amongst endodontic practitioners in the United States. J Endod 2017;43:699–704.
21. Caputo BV, Noro Filho GA, de Andrade Salgado DM, et al. Evaluation of the root canal morphology of molars by using cone-beam computed tomography in a Brazilian population: part I. J Endod 2016;42:1604–7. Radiology in Endodontics 485
22. Creanga AG, Geha H, Sankar V, et al. Accuracy of digital periapical radiography and cone-beam computed tomography in detecting external root resorption. Imaging Sci Dent 2015;45:153–8.
23. Karabucak B, Bunes A, Chehoud C, et al. Prevalence of apical periodontitis in endodontically treated premolars and molars with untreated canal: a conebeam computed tomography study. J Endod 2016;42:538–41.
24. Venskutonis T, Plotino G, Juodzbalys G, et al. The importance of cone-beam computed tomography in the management of endodontic problems: a review of the literature. J Endod 2014;40:1895–901.