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Improving Emergency Dental Raediography Response Times Through Coordination Between Dentists And Their Assistants Together With Patient Care Technicians, And Radiology Staff

Dr.Tamara Ahmed Aljawi[1],Dr.Majid Saeed Alsaaidi[2],Wedyan masad Alsehli[3],Raghad saleh alblwi[4],Azhaar nasser altayyar[5],Shoug Salem soliman bagour[6],Saleh Samel Alrashidi[7],Ayman wsaeel Alkhattabi[8],Majed Suwailem Alrasheedi[9],Ahmad Ayed R Aljohani[10]

[1]General dentist, Branch of the Ministry of Health Northern Borders Region
[2]Dentist, Alotaibi Health Center
[3]Dental Assistant, Alfaisaliah primary healthcare center, Madinah
[4]Dental assistant, Al-Salam Primary Healthcare Center, Madinah
[5]Dental assistant, Bab el majedi medical center
[6]Patient care technician, King Fahad hospital - Jeddah
[7]Senior Radiolgy Specialist, Public health administratio
[8]X ray technition, King Salman bin Abdulaziz Medical City
[9]Public health administration , Radiographer Technician
[10]Technician-Radiological Technology, Madinah Health Cluster

Abstract
Emergency dental radiography plays a crucial role in the accurate and timely diagnosis of traumatic dental injuries, odontogenic infections, and maxillofacial emergencies that can progress rapidly if not evaluated correctly. Despite advances in digital imaging and structured workflow design, delays in obtaining radiographs remain a major barrier to effective emergency dental care worldwide, often prolonging patient pain, increasing diagnostic uncertainty, and contributing to unnecessary complication rates. This comprehensive review assesses the significance of rapid radiographic response in dental emergencies and explores the coordinated roles of dentists, dental assistants, patient care technicians (PCTs), and radiology personnel in improving workflow efficiency, imaging accuracy, and patient outcomes. Global and national evidence—including health system quality transformation efforts within Saudi Vision 2030—emphasizes that an integrated model supported by healthcare communication technology, interdisciplinary training, and standardized imaging protocols significantly reduces response times and enhances continuity of care. The paper concludes with a framework for optimized emergency dental radiography response, emphasizing the synchronization of staff roles and digital workflow innovations to ensure timely diagnosis and appropriate intervention.

1. Introduction

Emergency dental radiography is an essential diagnostic component in the management of traumatic dental conditions such as root and crown fractures, luxation injuries, jaw fractures, and deep odontogenic infections that may compromise the airway if not treated urgently (Bianchi et al., 2021). Worldwide, dental trauma accounts for up to 17% of emergency department oral presentations, while odontogenic infections constitute one of the most frequent maxillofacial emergencies requiring hospital admission (Robertson et al., 2020). Radiographic imaging—including periapical, panoramic, and cone beam computed tomography (CBCT)—guides clinicians in evaluating anatomical structures, detecting complications, and determining appropriate therapeutic interventions. However, many healthcare systems struggle with delayed

radiography response times due to workflow fragmentation, staffing limitations, cross-department communication gaps, and inadequate imaging prioritization in emergency settings (Azodo & Ezeja, 2019).

In Saudi Arabia, emergency dental services continue to expand as part of Vision 2030 healthcare transformation initiatives, where the Ministry of Health emphasizes reduced wait times and care coordination through digital health expansion (Saudi Vision 2030, 2022). Yet, delays in emergency radiographic response persist in both public and private dental settings due to variability in training among dental auxiliaries, limited integration of radiology and dental imaging workflows, and insufficient utilization of imaging triage systems that prioritize urgent cases (Al-Hamdan et al., 2023). These inefficiencies not only lengthen patient suffering but can lead to diagnostic error, delayed surgical management, inappropriate antibiotic use, and avoidable hospital admissions (Prabhu et al., 2020).

Therefore, improving emergency dental radiography response times requires a coordinated, multidisciplinary model involving dentists who define the diagnostic need and urgency; dental assistants who prepare patients, equipment, and infection control workflows; patient care technicians who facilitate patient movement, documentation, and prioritization; and radiology staff who execute high-quality imaging protocols and support digital workflow integration. This paper examines how these collaborative roles can be optimized through workflow standardization, informatic systems, and continuous professional development to ensure that emergency dental imaging meets clinical requirements promptly and safely.

2. The Clinical Importance of Timely Radiography in Dental Emergencies

The clinical consequences of delayed radiographic imaging in dental emergencies can be profound. For instance, alveolar fractures or avulsed teeth require immediate radiographic evaluation as treatment delays beyond 60 minutes significantly decrease prognosis for periodontal ligament healing and risk long-term tooth loss (Andreasen & Bakland, 2021). Similarly, rapidly spreading odontogenic infections can progress from localized abscesses to life-threatening deep fascial space infections including Ludwig's angina, where immediate imaging is critical to airway assessment and surgical planning (Müller et al., 2020). Without timely radiographs, diagnosis becomes uncertain, treatment errors are more likely, and morbidity increases substantially.

Maxillofacial trauma imaging is even more time-sensitive. Zygomatic arch fractures, condylar fractures, and orbital floor injuries sometimes require urgent surgical intervention, and any delay in radiography impedes multidisciplinary care involving dental surgeons, otolaryngologists, and plastic surgeons (Shah et al., 2022). Additionally, incorrect imaging selection—such as periapical imaging instead of CBCT for suspected root fractures—wastes valuable time and increases radiation exposure, emphasizing the need for standardized emergency imaging decision-trees (Bianchi et al., 2021).

From a systems perspective, prolonged radiography wait times correlate with reduced patient satisfaction, increased emergency department length of stay, and higher costs of care (Azodo & Ezeja, 2019). In alignment with international patient safety standards and Saudi Vision 2030 patient-centered care objectives, emergency dental radiography must be optimized as an integral element of overall emergency quality improvement (Saudi Vision 2030, 2022).

3. The Role of Dentists in Radiography Coordination

Dentists are the primary decision-makers in emergency dental imaging and are responsible for determining the type of radiograph needed, communicating clinical urgency, and collaboratively planning efficient workflows with imaging teams. Miscommunication or insufficient clinical detail in radiology requests has been identified as a major contributor to delays, especially when radiology staff must clarify orders before

proceeding (Prabhu et al., 2020). Therefore, dentists must provide complete diagnostic indications, precise anatomical site information, and urgency classification.

Dentists additionally ensure patient safety and appropriateness of exposure by following ALARA principles—"as low as reasonably achievable"—and utilizing imaging modalities proportionate to clinical needs (Bianchi et al., 2021). Their leadership role extends to supervising dental assistants and PCTs in rapidly preparing patients and establishing correct positioning to minimize retakes, which otherwise lengthen imaging time and increase radiation dose.

In Saudi Arabia, dental emergency departments in major medical cities have implemented protocols requiring dentists to communicate directly with radiology staff for high-acuity trauma, significantly reducing median imaging waiting times (Al-Hamdan et al., 2023). Dentists are also key figures in multidisciplinary training programs that familiarize team members with trauma classifications, imaging priorities, and emergency CBCT applications in maxillofacial care. In this capacity, they drive coordination and standardization efforts that are essential for system-wide improvement.

4. Role of Dental Assistants in Workflow Efficiency and Infection Control

Dental assistants contribute significantly to radiographic response efficiency by preparing patients, assisting with equipment positioning, performing infection prevention measures, and ensuring rapid turnover of operatory spaces. Emergency dental patients often present in pain, distress, or with limited mobility due to trauma or swelling. Dental assistants' ability to communicate effectively, guide breathing and head stabilization, and calm anxious patients reduces motion artifacts and improves imaging success on the first attempt (Azodo & Ezeja, 2019).

Infection control is another critical responsibility, particularly because dental emergencies sometimes involve open wounds, suppurative infections, or the presence of blood and saliva, which increase contamination risk. Maintaining sterilized film holders, digital sensors, and lead aprons while adhering to strict cross-infection protocols helps prevent imaging delays attributed to shortages of clean equipment or mandatory re-sterilization cycles (Müller et al., 2020).

Dental assistants also ensure necessary imaging documentation, such as pregnancy screening in women of childbearing age, allergy verification, and consent processes, all of which must be accomplished rapidly without compromising standards. Empowering dental assistants through ongoing education in radiographic anatomy, emergency dental triage, and radiation safety notably enhances productivity and interdepartmental communication (Robertson et al., 2020).

5. Contribution of Patient Care Technicians to Patient Flow and Digital Coordination

Patient care technicians have emerged as important workflow facilitators in dental emergency units, especially where dentistry intersects with general emergency medicine. They support clinical staff by transporting patients to radiology departments, assisting in bed-to-chair transfers for patients with trauma or disability, and expediting intake and charting processes that would otherwise delay imaging requests (Al-Hamdan et al., 2023).

One of their most important contributions lies in digital coordination. PCTs can initiate electronic radiography orders under supervision, track pending studies, and communicate with radiology units to confirm readiness. These responsibilities significantly reduce the "silent delays" that occur when imaging orders sit unattended in digital queues (Shah et al., 2022). Their participation is especially valuable at night or during surge periods when clinical staff are occupied with direct care responsibilities.

By managing timestamps on order approval, radiology dispatch, patient movement, and image acquisition, PCTs support performance monitoring systems used for quality improvement under Vision 2030 digital health transformation initiatives (Saudi Vision 2030, 2022). The result is increased workflow transparency and accountability among departments.

6. Radiology Staff as Drivers of Imaging Quality and Timeliness

Radiology technologists are responsible for executing high-quality imaging that meets clinical specifications and avoids the need for retakes. Their expertise in modality selection, exposure settings, and patient positioning ensures diagnostic clarity while minimizing radiation exposure. Delays often arise when radiology units operate under first-come-first-served models that do not prioritize dental emergencies such as suspected maxillofacial fractures (Müller et al., 2020).

Implementing a triage policy that prioritizes dental trauma imaging—especially in combination with hospital-level trauma protocols—can significantly reduce wait times and improve patient outcomes (Bianchi et al., 2021). Additionally, radiology staff enhance efficiency by maintaining equipment uptime, ensuring proper calibration of digital sensors, and utilizing mobile imaging solutions when transferring unstable patients would be unsafe.

Effective communication between radiology and dentistry teams is facilitated by standardized imaging request forms, PACS-integrated messaging, and teleconsultation pathways that allow radiologists to clarify clinical needs before image acquisition. Under national accreditation guidelines, Saudi hospitals now require radiology departments to integrate turnaround-time indicators into their performance evaluations, positively influencing emergency imaging operations (Saudi Vision 2030, 2022).

Table 1. Multidisciplinary Alignment for Improved Emergency Dental Radiography Response

Team Member	Key Functions	Contribution to Timeliness	Patient Outcome Benefits
Dentist	Imaging selection, urgency communication	Eliminates ordering delays	Faster diagnosis, reduced complications
Dental Assistant	Preparation, positioning, infection control	Minimizes retakes, smooth workflow	Higher image quality, fewer radiation exposures
PCT	Patient flow, system documentation	Reduces queue delays	Shorter wait periods, better continuity
Radiology Staff	Image acquisition, modality expertise	Fast, accurate radiography	Improved trauma and infection management

7. Digital Integration and Healthcare Informatics

Healthcare informatics enhances coordination by enabling real-time radiology order tracking, automated escalation alerts for urgent imaging, and integration of imaging results into the dental EHR for immediate review. Artificial intelligence (AI)-supported triage tools can prioritize imaging requests flagged as emergent based on clinical descriptors entered by dentists, thus reducing reliance on verbal communication pathways (Chen et al., 2022).

Saudi Arabia's Seha Virtual Hospital initiative provides a foundation for remote radiology review, where radiologists in centralized hubs assist dental departments with emergency image interpretation during off-hours, accelerating treatment decisions in hospitals with limited on-site maxillofacial imaging expertise (Saudi Vision 2030, 2022).

PACS-linked communication tools allow dentists to rapidly annotate images for surgical planning, create 3D reconstructions for trauma management using CBCT data, and collaborate with oral surgeons and ENT specialists across institutions. Data captured through digital timestamps enable audit programs that identify causes of imaging delays and drive continuous quality improvement.

8. Challenges and Future Directions

Despite clear benefits, several barriers must be addressed. Staffing shortages in radiology are common globally, often causing bottlenecks at peak emergency hours (Shah et al., 2022). Dental clinics without internal radiography units rely on shared hospital radiology resources, leading to competing priorities. Moreover, inconsistent training in emergency radiographic protocols among dental assistants and PCTs can lead to workflow errors and repeat imaging.

Future improvements should focus on competency-based training, streamlined communication protocols, remote digital radiology systems, and enhanced PACS-EHR interoperability. Developing national imaging guidelines tailored for dental emergencies—as part of Saudi Vision 2030's regulatory transformation—would strengthen uniformity in care delivery and ensure patients receive timely radiographic evaluation regardless of hospital location (Al-Hamdan et al., 2023).

9. Conclusion

Timely radiographic evaluation is essential to emergency dental care. Delays in imaging increase clinical uncertainty, risk severe complications, and decrease overall patient satisfaction. Achieving optimal efficiency requires coordinated action among dentists, dental assistants, PCTs, and radiology staff within a digitally integrated workflow environment. Strengthening communication, standardizing imaging triage, expanding staff education, and leveraging healthcare informatics will significantly reduce response times and improve outcomes. With the support of national transformation initiatives such as Saudi Vision 2030, emergency dental radiography systems can evolve into high-reliability care models that restore function, prevent complications, and elevate patient experience.

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