Journal of Dental Sciences 21 (2026) 650–651

Available online at www.sciencedirect.com

ScienceDirect

journal homepage: www.e-jds.com

Correspondence

Current challenges of safety management and supervision for the dental radiology diagnosis equipment in Taiwan

KEYWORDS
Nuclear Safety Commission;
Radiation protection;
Dental institutions;
Dental X-ray machines;
Safety management

With the rapid advances in development of science and technology, the ionizing radiation is used increasingly in the fields related to people's livelihood, such as the medicine, dentistry, agriculture, industry, border control, and academic research. Consequently, the use of radiation sources (including equipment that can generate the ionizing radiation and radioactive materials) has increased annually, leading to a growing demand for the personnel qualified to operate radiation sources and the safety management of radiation sources. Taiwan's Atomic Energy Council (AEC) was reorganized into the Nuclear Safety Commission (NSC) in 2023, continuing to oversee the radiation protection and nuclear safety management. In addition to compiling the annual reports on the use of radiation in various fields, the radiation protection authority has also developed a mechanism for the safety management and supervision of radiation sources. The dental radiology diagnosis equipment is the largest component of this mechanism.[1,2] This article reported on how this supervisory mechanism managed the safety of the dental X-ray machines and the current challenges of this mechanism.

The architecture of this monitoring mechanism is shown in Fig. 1. The AEC radiation protection control system, launched in 2007, has evolved into a cloud-based radiation protection service system with advancements in information technology. This cloud-based service system (called the RadiCloud System) is designed to support multiple browsers and enhance security. For dental institutions, the installation, use, modification, and decommissioning of the dental X-ray machines must also be conducted under this monitoring mechanism. When a dental institution purchases a new dental X-ray machine, the sales service provider should complete the installation for the customer. The detection service provider then completes a test report confirming that the installed dental X-ray machine complies with the regulations (including X-ray room shielding, safety interlocks, radiation warning devices, and radiation leakage levels). The sales service provider and the detection service provider can be the same or separate companies. The dental institution then must log in to the RadiCloud System and upload the test report. After the NSC's online review is approved, the dental institution can download the dental X-ray machine's license file from the RadiCloud System. Thereafter, a test report must be completed every five years to confirm compliance with the regulations. However, this report does not need to be uploaded to the RadiCloud System. It should be kept for the future reference. A new test report is only required for re-review if the dental X-ray machine is modified or relocated. Furthermore, when a dental X-ray machine is permanently decommissioned, the dental institution must upload the photographs of the decommissioned machine for the NSC's review. The dental institutions can view their dental X-ray machine licenses and quantity in the RadiCloud System, while the NSC can monitor the usage status and quantity of the dental X-ray machines nationwide. If necessary, the

https://doi.org/10.1016/j.jds.2025.09.005

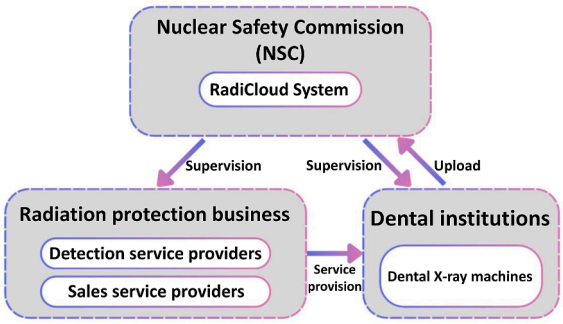

Figure 1 The architecture of the safety management and supervision for the dental X-ray machines in Taiwan.

NSC can also conduct the physical inspections of the dental institutions, the detection service providers, and the sales service providers.

By the end of 2024, Taiwan had 22,167 medical devices that emit ionizing radiation, including 15,312 dental X-ray machines, accounting for 69.1 % of the total. Of these dental X-ray machines, 14,412 were located in the dental clinics, accounting for 94.1 %.[1] Furthermore, there were 16,690 dentists working in 7309 dental institutions (including the 212 hospital dental departments and 7097 dental clinics).[3] This means that the medical devices that emit ionizing radiation under the supervision of the NSC are primarily dental X-ray machines, and these machines are primarily located in the dental clinics across Taiwan. Therefore, the NSC's cloud-based system for reviewing the test reports of each dental X-ray machine as a supervisory mechanism is the most suitable method for the safety management. In fact, Taiwan is located in an earthquake zone and is prone to typhoons in summer. In the case of frequent earthquakes, wind disasters and floods, the damage to building structures and the aging and damage of X-ray machines may cause the radiation leakage. Even though the radiation dose from the dental X-ray machines is extremely low, the radiation leakage still poses a risk of long-term and low-dose radiation exposure to the dental staff.[4] Thereby, the potential health risks are difficult to assess. This demonstrates the continued need for the safety management and oversight of the dental X-ray machines. In Taiwan, there are so many dental X-ray machines that almost every dentist is assigned one. The NSC cannot physically oversee every single dental X-ray machine. Therefore, in addition to operational skills, it is crucial for every dentist to develop a sound understanding of the radiation protection and implement the safety management practices.

Declaration of competing interest

The authors have no conflicts of interest relevant to this article.

Acknowledgments

We are grateful to Yi-Hsin Cheng, the student of Taipei Municipal Dazhi High School, for designing and producing the schematic diagram of Fig. 1 in this article.

References

1. Nuclear Safety Commission. *2024 statistics of lonizing radiation applications and management*. Taipei, Taiwan: Nuclear Safety Commission, 2025.
2. Cheng FC, Chen HY, Chiang CP. A special system of radiology diagnosis equipment operating license for the dentists and its development history in Taiwan. *J Dent Sci* 2024;19:1863–7.
3. Ministry of Health and Welfare. *2024 annual report on medical institution service volume statistics*. Taipei, Taiwan: Ministry of Health and Welfare, 2025.
4. Cheng FC, Lee MC, Chen MH, et al. Occupational radiation exposure for various medical radiation workers, especially the dental radiation workers, in Taiwan from 2013 to 2020. *J Dent Sci* 2022;17:1544–52.

Feng-Chou Cheng
Chia-Te Dental Clinic, New Taipei City, Taiwan
School of Life Science, College of Science, National Taiwan Normal University, Taipei, Taiwan
Science Education Center, National Taiwan Normal University, Taipei, Taiwan

Mu-Hsiung Chen
Department of Dentistry, National Taiwan University Hospital, College of Medicine, National Taiwan University, Taipei, Taiwan

Sheau-Jing Yu**
Department of Medical Imaging, National Taiwan University Hospital, College of Medicine, National Taiwan University, Taipei, Taiwan

Chun-Pin Chiang*
Department of Dentistry, National Taiwan University Hospital, College of Medicine, National Taiwan University, Taipei, Taiwan
Graduate Institute of Oral Biology, School of Dentistry, National Taiwan University, Taipei, Taiwan
Department of Dentistry, Hualien Tzu Chi Hospital, Buddhist Tzu Chi Medical Foundation, Hualien, Taiwan
Institute of Oral Medicine and Materials, College of Medicine, Tzu Chi University, Hualien, Taiwan

** Corresponding author. Department of Medical Imaging, National Taiwan University Hospital, College of Medicine, National Taiwan University, No. 1, Chang-Te Street, Taipei, 10048, Taiwan.
E-mail address: christabear@gmail.com (S.-J. Yu)

* Corresponding author. Department of Dentistry, Hualien Tzu Chi Hospital, Buddhist Tzu Chi Medical Foundation, and Institute of Oral Medicine and Materials, College of Medicine, Tzu Chi University, No. 707, Section 3, Chung-Yang Road, Hualien 970, Taiwan.
E-mail address: cpchiang@ntu.edu.tw (C.-P. Chiang)

Received 4 September 2025
Available online 24 September 2025