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Perspective article

# The dental radiographic equipment “Special Diana” in the Taiwan Government Tainan hospital during the Japanese colonial period

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The German physicist Wilhelm Conrad Röntgen discovered X-rays in November 1895. News of the discovery of X-rays reached Japan the following February. Then, the Japanese scholars quickly began experiments related to medical radiography. In October 1896, they successfully took the X-ray photographs. The following year, in 1897, the Shimadzu

Corporation commercialized the X-ray equipment for educational use. The capability to perform practical X-ray experiments drew widespread interest within the education sector and became an important component of many teaching environments.<sup>1</sup>

In 1913, the United States invented a new type of X-ray tube, the Coolidge tube, significantly improving the efficiency and miniaturization of the X-ray equipment. In 1918, the Shimadzu Corporation launched the “Diana” and “New Aurora” medical X-ray devices equipped with the Coolidge tubes. These devices were more portable and compact, becoming popular in the private clinics and large hospitals, and were exported overseas and received a high praise.<sup>1</sup>

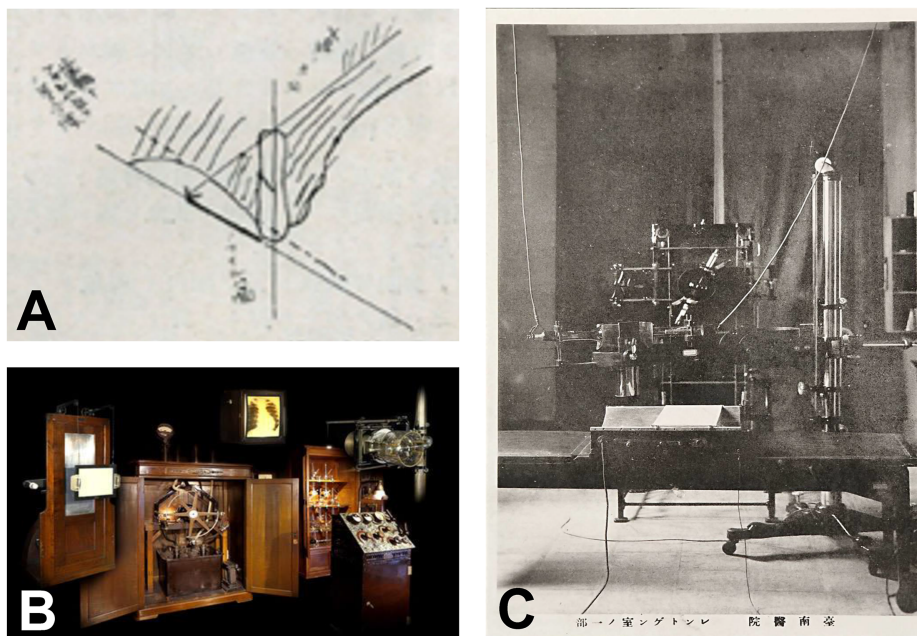
During the Japanese colonial period (1895–1945), Taiwan was deeply influenced by the Japanese technological and medical advancements. As a Japanese overseas territory at that time, Taiwan naturally had the opportunity to quickly import the latest medical equipment from the mainland Japan. In fact, the medical institutions under the Taiwan Government typically imported necessary medical materials and equipment from the mainland Japan. For example, a 1906 newspaper report stated that the newly established dental department in the Taiwan Government Taipei Hospital would begin operations once all dental materials and equipment had been imported from the mainland Japan.<sup>2</sup>

Previously, we reported on Mr. Sakae Kawahara (1904–1943), a medical equipment technician in the Taiwan Government Tainan Hospital, whose story involves

the introduction of the latest medical equipment from the mainland Japan to Taiwan. The Tainan Hospital was officially established in June 1898, its predecessor dating back to an outpatient clinic established in November 1895 within the Tainan Civil Affairs Department, staffed by army medical officers. In March 1913, its dental department was completed, becoming one of the few hospital dental departments at that time. In 1925, Mr. Kawahara worked at the Physical Therapy Department of the Taiwan Government Taipei Hospital. This was his earliest medical-related work. In 1929, he was transferred to the Taiwan Government Tainan Hospital and was ordered to serve as the director for managing X-ray radiation equipment.<sup>3</sup>

The Journal of the Taiwan Radiology Association was founded in 1932. Soon, Mr. Kawahara published an academic paper related to the dental radiology entitled “the dental X-ray photography technology” in its Volume 1, Issue 2.<sup>3</sup> This meant that the dental radiology was a novel specialty field in those days. In his paper, Mr. Kawahara indicated that he was from the Radiology Department of the Taiwan Government Tainan Hospital. This paper mainly described the technique of intraoral dental radiography, now known as the finger-supporting periapical film of bisecting-angle technique (Fig. 1A), and the composition of the developer and fixer.<sup>3,4</sup>

It is intriguing to wonder what kind of X-ray machine Mr. Kawahara used for the dental radiography. In his paper, he mentioned the machine he used was called the “Special Diana”, manufactured by the Shimadzu Corporation.



**Figure 1** The photographs related to the technique of dental radiography and the medical X-ray equipment cited in this article. (A) Mr. Sakae Kawahara’s hand-drawn illustration of the bisecting-angle technique for the periapical radiography was published in the Journal of the Taiwan Radiology Association in 1932. (B) The original “Diana” X-ray machine is currently exhibited at the Shimadzu Foundation Memorial Museum, preserved in a condition that closely reflects its original use in medical practice. (C) A postcard from the Japanese colonial period featuring a photograph of a section of the Radiology Department of the Taiwan Government Tainan Hospital, while the equipment in the photograph is the medical X-ray machine at that time. The photograph in (B) was available from the current website of the Shimadzu Corporation. The postcard in (C) is the personal collection of Feng-Chou Cheng, the first author of this article.

Following this lead, we found more information about the “Diana” on the current website of the Shimadzu Corporation. The Shimadzu Corporation successfully took its first X-ray photograph in 1896. By 1909, it had developed Japan’s first medical X-ray device. The general-purpose medical X-ray device “Diana” was first introduced in 1918 and remained in production until 1932. The original “Diana” X-ray machine is currently exhibited at the Shimadzu Foundation Memorial Museum, preserved in a condition that closely reflects its original use in medical practice (Fig. 1B).<sup>1</sup> Fortunately, we have a postcard from the Japanese colonial period, featuring a photograph of a section of the Radiology Department of the Taiwan Government Tainan Hospital, while the equipment in the photograph is the medical X-ray machine at that time (Fig. 1C). We inferred that it is likely the “Special Diana” mentioned by Mr. Kawahara in his paper. Compared to the “Diana” exhibited at the Shimadzu Foundation Memorial Museum, the “Special Diana” appears much lighter and more compact. This meant that with the advancement of radiological technology, the “Diana” may have undergone a model upgrade, making it lighter and more compact.

Although the Shimadzu Corporation released the “Hokuto”, a domestically produced dental X-ray device, which used a Coolidge tube, in 1922, Mr. Kawahara, upholding his academic research spirit, developed a technique for using the general-purpose medical X-ray equipment to perform the dental radiography. This not only indicated the scarcity of expensive medical equipment at that time when the Tainan Hospital likely lacked a dedicated dental X-ray machine, but also highlighted Mr. Kawahara’s admirable dedication to Japanese craftsmanship. Later, in 1941, he obtained the technician qualification for the operation of X-ray radiation equipment approved by the General Testing Committee of the Taiwan Government.<sup>3</sup> This study provided a multi-faceted research

approach to the dental history. By analyzing the content of early academic writings, we can discover clues and find answers to our research questions, combined with the search of historical materials. This article proved the fact that the medical equipment technicians in hospitals during the Japanese colonial period used the general-purpose medical X-ray machines to perform the dental radiography.

## Declaration of competing interest

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

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