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Intraoral digital radiography: A comprehensive report on the technical specifications of current and historical systems

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ABSTRACT

Purpose: The aim of this study was to identify, compile, and report the technical specifications of current and historical intraoral digital radiographic systems and recommend standardised reporting practices for production companies.

Materials and Methods: A comprehensive report was prepared on 150 intraoral digital radiographic systems, comprising 105 sensor-based (70%) and 45 phosphor storage plate (PSP)-based systems (30%). Technical specifications were obtained from official company sources and scientific articles to ensure a complete collection of available data.

Results: These systems were produced by 55 companies across 11 countries, with the United States leading (35.3%), followed by France (12%). Among the sensor systems, 76.2% used complementary metal-oxide-semiconductor (CMOS) technology, with notable variations in sizes and resolutions. PSP systems were available in 7 plate sizes and displayed diverse resolutions and scanning times. Twenty-one companies produced both sensor- and PSP-based systems, 33 produced only sensor-based systems, and 1 produced exclusively PSP-based systems.

Conclusion: This report identified 150 digital radiographic systems, revealing wide variability in technical specifications and a lack of standardised reporting protocols. The comprehensive summary and recommendations for consistent documentation provided here can help clinicians make informed decisions and encourage manufacturers and production companies to adopt uniform reporting standards aligned with local regulatory frameworks. ***(Imaging Sci Dent 2025; 55: 72-89)***

KEY WORDS: Dental Digital Radiography; Dentists; History, Dentistry

Introduction

Digital radiography offers several advantages over film-based radiography, including increased X-ray sensitivity, the ability to adjust brightness and contrast dynamically, ease of sharing images across locations, and the elimination of chemical processing.[1,2] However, the lack of lead foil in digital radiography may result in higher X-ray exposure,[3] and infection control remains challenging because reusable receptors cannot be sterilised, particularly if protective barriers become compromised.[4,5] Intraoral digital radiographic systems typically employ either solid-state sensors or photostimulable phosphor (PSP) plates. Solid-state sensors enable faster imaging but have a relatively smaller

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active surface area, while PSP plates offer greater flexibility and patient comfort yet are more prone to damage from scratches, bite marks, and ambient light. Additionally, PSP plates require scanning before image evaluation, resulting in a delay in image availability.[6-9] Solid-state sensors often incorporate either charge-coupled device (CCD) or complementary metal-oxide semiconductor (CMOS) technologies, frequently with a scintillation layer to facilitate X-ray capture.[1]

The evolution of digital intraoral radiography systems has significantly enhanced diagnostic quality and clinical efficiency. The first breakthrough came with the launch of RadioVisioGraphy (RVG 25000) by Trophy (Croissy-Beaubourg, France) in 1987, marking the debut of a digital, sensor-based system for intraoral radiography.[1,10,11] Despite initial limitations in image quality, detector size, and cost compared to subsequent systems, the RVG 25000 quickly gained acceptance, particularly in France and other regions where reimbursement policies supported the adoption of electronic technologies. This early success spurred global interest and further investment in digital radiography.[10]

During the 1990s, digital imaging evolved rapidly, with several key innovations entering the market. One major development was the introduction of Visualix in 1991, which featured a CCD sensor.[12] Subsequently, other companies such as Regam Medical Systems with Sens-A-Ray introduced similar systems that employed full-area sensors with improved image quality. This period also saw the transition from analogue to digital sensors, with CMOS technology addressing early challenges in image quality and sensor durability. By the late 1990s, CMOS sensors had become widely adopted due to their cost-effectiveness, improved image quality, and reduced power consumption, gradually replacing CCD sensors in intraoral radiography.[10] The decade also witnessed the emergence of PSP-based receptors in 1994, which offered a superior dynamic range compared to sensor-based systems.[10,11] By the early 2000s, digital intraoral radiography systems were available from numerous manufacturers, with ongoing advancements in both hardware and software.[13] This transition from film-based to digital radiography not only improved image quality but also significantly reduced patient radiation exposure, enhanced diagnostic efficiency, and streamlined dental practice workflows.[1] Today, digital radiography remains a cornerstone of modern dental diagnostics, with recent innovations—such as photon-counting and single crystal direct conversion silicon/CMOS (Si-CMOS) sensors—aiming to eliminate light transformation and thereby improve theoretical image sharpness.[14,15]

The diversity in technical specifications among digital intraoral radiographic systems presents a challenge for professionals seeking to select systems that best meet their needs. Variability in specification reports and incomplete disclosure of system features by production companies further complicate the selection process. Additionally, the production and marketing of specific digital systems often involve multiple entities; the manufacturer produces the system, while production companies manage the brand identity, including visual elements, messaging, and market positioning. Dental practitioners may be familiar with either the manufacturer, the production company, or both, which may operate as a single entity or as independent companies.

Considering these complexities, a comprehensive report detailing the technical specifications of both historical and contemporary digital systems would aid in comparing systems and identifying areas for improvement in standardised and clinically relevant reporting. Therefore, this study aimed to appraise, compile, and report the technical specifications of current and historical intraoral digital radiographic systems and to propose standardised reporting practices for production companies.

Materials and Methods

A comprehensive investigation of historical and current intraoral digital radiographic systems was conducted between June 2024 and August 2024. Three authors (MSO, TGP, and MLO) initiated an online search using Google (https://www.google.com) with individual and combined keywords such as “dental digital radiography”, “intraoral”, “intra-oral”, “radiograph”, “digital system”, “digital radiographic system”, “psp”, “phosphor”, “plate”, “photostimulable”, “solid-state”, and “sensor”. Each search result was examined until no additional relevant information regarding intraoral digital radiographic systems was found. When an entry contained a hyperlink to a production company’s official website, manual, catalogue, or brochure, the available technical specifications were collected.

If technical specifications were unavailable, a second Google search was conducted using the identified system name combined with keywords such as “manual”, “catalogue”, “brochure”, “PDF”, and “technical specifications”. Additionally, the official websites of production companies for all identified systems were reviewed to uncover any systems that had not been previously identified. Finally, an online search on MEDLINE (https://pubmed.ncbi.nlm.nih.gov) was performed for discontinued intraoral digital

radiographic systems that had not been found in earlier searches. No restrictions were imposed regarding publication language or date.

The gathered material was scrutinised to ensure that every available technical specification was collected and subsequently compiled into a spreadsheet. Given the inherent differences between sensor- and PSP-based systems, technical specifications were recorded as follows: 1) Sensor-based systems: brand, production country, model, technology, sensor sizes, sensor dimensions, active area dimensions, pixel size, spatial resolution, contrast resolution, sensor weight, connection interface, cable length, image file size, software, manufacturer, and source. 2) PSP-based systems: brand, production country, model, PSP sizes, pixel size, spatial resolution, contrast resolution, minimum scanning time, scanner weight, scanner dimensions, laser wavelength, connection interface, image file size, software, manufacturer, and source.

The technical specifications were then tabulated. After careful review and discussion, recommendations for standardised reporting of technical specifications were proposed to production companies to enable comparisons among systems, streamline evaluation for potential users, and support future research in intraoral digital imaging.

Results

A total of 150 intraoral digital radiographic systems were identified, including 105 sensor-based systems (70%) and 45 PSP-based systems (30%). These systems were produced by 55 different companies; of these, 21 produced both sensor- and PSP-based systems, 33 produced only sensor-based systems, and 1 produced exclusively PSP-based systems. The production companies of sensor-based systems were located in 11 countries (Brazil, China, Finland, France, Germany, India, Italy, Japan, South Korea, Sweden, and the United States), while those for PSP-based systems were based in 8 countries (Brazil, China, Finland, France, Germany, Italy, South Korea, and the United States). The number of digital intraoral radiographic systems by production country is shown in Table 1. The United States accounted for the greatest number of brands (35.3% of all systems, 35.2% of sensor-based systems, and 35.6% of PSP-based systems), followed by France (12% of all systems).

Table 1. Absolute and relative (in percentage) numbers of sensor- and phosphor storage plate (PSP)-based intraoral digital radiographic systems, categorised by production country

Country	Sensor	PSP	Total
Brazil	9	1	10 (6.7%)
China	7	3	10 (6.7%)
Finland	9	6	15 (10.0%)
France	16	2	18 (12.0%)
Germany	5	11	16 (10.6%)
India	1	0	1 (0.7%)
Italy	11	3	14 (9.3%)
Japan	2	0	2 (1.3%)
South Korea	7	3	10 (6.7%)
Sweden	1	0	1 (0.7%)
United States	37	16	53 (35.3%)
Total	105	45	150 (100.0%)

Sensor-based systems

Among the 105 sensor-based intraoral radiographic systems, 82.8% had their technical specifications obtained from production companies' documents, while the remaining 17.2% were sourced from scientific articles that provided only limited details relevant to the research. In terms of sensor technologies, 100 systems (95.2%) used indirect conversion technology, and 5 systems (4.8%) employed direct conversion technology. Of the 100 systems with indirect conversion, 80 (80%) used CMOS and 20 (20%) used CCD technology. Among the 5 systems with direct conversion, 2 (40%) were photon-counting based and 3 (60%) were Si-CMOS based. Reported sensor sizes included 0, 0.8, 1, 1.5, and 2, with 68 systems (64.8%) featuring sizes 1 and 2. Pixel sizes varied from 14 to 50 μm. Theoretical spatial resolution ranged from 3.8 to 35.7 lp/mm, true spatial resolution from 6 to 28 lp/mm, and contrast resolution from 8 to 24 bits. When disclosed, all systems supported a Universal Serial Bus (USB) connection. Cable lengths ranged from 1 to 5 m. File sizes varied from a minimum of 0.43 MB to a maximum of 8 MB. Thirty-three different viewer software applications were identified. The most frequently missing information was sensor weight, which was absent in 90 systems (85.7%). Seventeen systems were found to be manufactured by a company different from the production company. Detailed technical specifications for the sensor-based systems are presented in Table 2.

PSP-based systems

For the 45 PSP-based intraoral radiographic systems, 97.8% had technical specifications obtained from production companies' documents, with the remaining 2.2% sourced from scientific articles. Seven PSP plate sizes were

Table 2. Technical specifications of the 105 sensor-based digital intraoral radiographic systems as a function of the 54 brands and their countries

Model	Technology	Size	Sensor size 0 (mm)			Sensor size 1 (mm)			Sensor size 2 (mm)			Active area 0 (mm)		Active area 1 (mm)		Active area 2 (mm)		Pixel size (µm)
			Length	Width	Depth	Length	Width	Depth	Length	Width	Depth	Length	Width	Length	Width	Length	Width	
1. Acteon (France)																		
SOPIX	CMOS	1, 2	–	–	–	38.9	24.9	5.3	42	30.4	5.3	–	–	30	20	34	26	20
SOPIX PLUG-IN	CMOS	1, 2	–	–	–	38.9	24.9	5.3	42	30.4	5.3	–	–	30	20	34	26	20
SOPIX^2	CMOS	1, 2	–	–	–	38.9	24..9	5.3	42	30.4	5.3	–	–	30	20	34	26	20
SOPIX^2 PLUG-IN	CMOS	1, 2	–	–	–	38.9	24..9	5.3	42	30.4	5.3	–	–	30	20	34	26	20
u.sense HD	CMOS	1, 2	–	–	–	38.6	24.7	5.2	43.2	30.8	5.2	–	–	30	20	34	26	20
2. Air Techniques (United States)																		
SensorX	CMOS	1, 2	–	–	–	39	27.4	6.3	44.7	33.1	6.3	–	–	30	20	36	26	19
3. Alerio (India)																		
Mezzo	CMOS	–	–	–	–	37	30	5	–	–	–	–	–	30	25	–	–	–
4. Apixia (United States)																		
Dirigex Digital	CMOS	1, 2	–	–	–	38.2	28.2	6.3	32.7	44	6.3	–	–	31.5	23	37.2	27.6	18.5
5. Athlos (Finland)																		
DC-Air	Si-CMOS	2	–	–	–	–	–	–	–	–	–	–	–	–	–	35.1	24.7	26
6. Carestream Dental (United States)																		
RVG 142	CMOS	1, 2	–	–	–	37.7	27.6	7.3	44.2	32.3	7.3	–	–	29.6	22.2	35.5	26.6	–
RVG 5100	CMOS	1, 2	–	–	–	–	–	–	–	–	–	–	–	29.6	22.2	35.5	26.6	18.5
RVG 5200	CMOS	1, 2	–	–	–	37.7	27.6	7.3	44.2	32.3	7.3	–	–	29.6	22.2	35.5	26.6	–
RVG 6100	CMOS	0, 1, 2	–	–	–	–	–	–	–	–	–	22.2	16.6	22.2	9.6	35.5	26.6	18.5
RVG 6200	CMOS	1, 2	–	–	–	37.7	27.6	7.3	44.2	32.3	7.3	–	–	29.6	22.2	35.5	26.6	–
7. Cygnus Technologies (United States)																		
CygnusRay MPS	CCD	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	20
8. D700 (Brazil)																		
D700 Slim	CMOS	1, 2	–	–	–	38.3	24.7	–	44.2	30.6	–	–	–	30	20	36	26	–
Digital Sensor	CMOS	1, 2	–	–	–	38.3	24.7	–	44.2	30.6	–	–	–	30	20	36	26	–
9. Dabi Atlante (Brazil)																		
Eagle	CMOS	1, 2	–	–	–	38.3	24.7	–	44.2	30.6	–	–	–	30	20	36	26	–
Eagle S	CMOS	0, 1, 2	30.3	21.7	–	38.3	24.7	–	30.6	44.2	–	22	17	30	20	36	26	20
New IDA	CMOS	0, 1, 2	30.3	21.7	–	38.3	24.7	–	30.6	44.2	–	22	17	30	20	36	26	–
10. DE Healthcare Products (United States)																		
Carina	CMOS	1.5	–	–	–	38.83	29.63	13.01	–	–	–	–	–	32.99	25.82	–	–	19.5
11. Dentium (South Korea)																		
Clear	CMOS	1, 2	–	–	–	36.7	24	5.1	42.6	29.1	5.1	–	–	30	20	36	25.6	20
12. Dentron Systems (United States)																		
Dentron USB	CMOS	1, 2	–	–	–	36	26	–	43	32	–	–	–	30	20	36	26	18
QuickRay	CMOS	1, 2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
UniRay HD	CMOS	1.5	–	–	–	39.5	29.2	–	–	–	–	–	–	33	24	34	26	14.9
13. Dentsply Sirona (United States)																		
Schick 33	CMOS	0, 1, 2	31.9	23.6	7.5	38.3	25.4	7.5	43	31.2	7.5	24	18	30	20	36	25.6	–
Schick AE	CMOS	0, 1, 2	32	23.6	7.5	38.3	25.4	7.5	43	31.2	7.5	–	24	30	20	36	25.6	–
Schick Elite	CMOS	0, 1, 2	38.4	26.5	6.7	38.4	25.3	6.7	43.9	32.2	6.3	24	18	30	20	36	26	–
Schick WiFi	CMOS	0, 1, 2	31.9	23.6	7.5	38.3	25.4	7.5	43	31.2	7.5	24	18	30	20	36	25.6	30

Table 2. Continued

Model	Technology	Size	Sensor size 0 (mm)			Sensor size 1 (mm)			Sensor size 2 (mm)			Active area 0 (mm)		Active area 1 (mm)		Active area 2 (mm)		Pixel size (μm)
			Length	Width	Depth	Length	Width	Depth	Length	Width	Depth	Length	Width	Length	Width	Length	Width	
Xios AE	CMOS	0, 1, 2	28.2	19.4	7.5	34.2	21.5	7.5	40.2	27.1	7.5	–	24	30	20	36	25.6	–
XIOS XG Select	CMOS	0, 1, 2	32	23.5	6.3	38.4	25.3	6.3	43.9	31.2	6.3	24	18	30	20	36	25.6	–
XIOS XG Supreme	CMOS	0, 1, 2	32	23.6	7.5	38.4	25.4	7.5	43	31.2	7.5	24	18	30	20	36	25.6	–
14. Dexis (United States)																		
IXS	CMOS	1, 2	–	–	–	37	25.2	8.3	30.4	–	8.5	–	–	30	20	36	26	19.5
Platinum	CMOS	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	19.5
Titanium	CMOS	2	–	–	–	39.9	29.8	8.6	–	–	–	–	–	33	26	–	–	19.5
Ti2	CMOS	1	–	–	–	39.86	29.76	–	–	–	–	–	–	–	–	–	–	19.5
15. DIGIMED (South Korea)																		
DVS-200	CMOS	2	38.7	29.2	4.9	–	–	–	–	–	–	–	–	–	–	33	24	20
16. Digital Doc (United States)																		
Blü	CMOS	1, 2	–	–	–	36.8	25.4	4.8	42.9	31.3	4.8	–	–	30	20	36	26	18
17. Dürr Dental (Germany)																		
VistaRay 7	CMOS	1, 2	–	–	–	39	27.4	6.3	44.7	33.1	6.3	–	–	30	20	36	26	19
18. Eastman Kodak (United States)																		
Kodak RVGui	CMOS	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	18.5
RVG 5000	CMOS	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	18.5
RVG 6000	CMOS	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	18.5
19. Fona (Italy)																		
StarX Pro	CMOS	1, 2	–	–	–	35.4	28	5.3	39	25	5.6	–	–	30	20	34	26	20
20. Fussen (China)																		
F100	CMOS	1, 2	–	–	–	38.53	25.03	4.5	45	31.62	4.5	–	–	30	20	35	26	–
21. Gendex (United States)																		
Visualix	CCD	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	22
VisualiX eHD	CCD	1, 2	–	–	–	37.5	25.5	7	40.5	33	7	–	–	31	20	34	27	19.5
22. Genoray (South Korea)																		
GIX 1	CMOS	1, 2	–	–	–	–	–	–	–	–	–	–	–	30	20	34	26	20
PortView	CMOS	1, 2	–	–	–	36.73	24.35	–	42.9	30.49	–	–	–	–	–	–	–	20
23. Hamamatsu Photonics K.K. (Japan)																		
Apex	CMOS	1, 2	–	–	–	39	25	5.3	41.9	30.4	4.3	–	–	30	20	34	26	–
24. Handy (China)																		
HDR-360	CMOS	1	–	–	–	39	28.5	6	–	–	–	–	–	30	22.5	–	–	18.5
HDR-460	CMOS	2	–	–	–	–	–	–	44.5	33	6	–	–	–	–	36	27	18.5
HDR-500	CMOS	1	–	–	–	39	28.5	6	–	–	–	–	–	30	22.5	–	–	18.5
HDR-600	CMOS	2	–	–	–	–	–	–	45	33	6	–	–	–	–	36	27	18.5
25. HDX Will (Germany)																		
Dentra III	CMOS	1, 2	–	–	–	37.7	27.6	7.3	44.2	32.3	7.3	–	–	29.6	22.2	35.5	26.6	–
26. ImageWorks (United States)																		
EVA Select	CMOS	1, 2	–	–	–	36.7	24.4	5.4	42.8	30.5	5.4	–	–	30	20	36	25.99	19
27. Instrumentarium (Finland)																		
Sigma	CCD	1, 2	–	–	–	36	24	–	40	30	–	–	–	32	20	34	26	19.5
Sigma M	CMOS	1, 2	–	–	–	37	26	–	44	31	–	–	–	30.02	19.95	36.48	25.84	19

Table 2. Continued

Model	Technology	Size	Sensor size 0 (mm)			Sensor size 1 (mm)			Sensor size 2 (mm)			Active area 0 (mm)		Active area 1 (mm)		Active area 2 (mm)		Pixel size (μm)
			Length	Width	Depth	Length	Width	Depth	Length	Width	Depth	Length	Width	Length	Width	Length	Width	
Snapshot	CMOS	1, 2	–	–	–	37	26	–	44	31	–	–	–	30.02	19.95	36.48	25.84	19
28. Integra Medical (United States)																		
ViperRay	CCD	-	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	22.5
29. J Morita (Japan)																		
Megadixel	CCD	-	–	–	–	–	–	–	–	–	–	–	–	30	20	–	–	20
30. Kavo (Germany)																		
KaVo ProXam iS	CMOS	0, 1, 2	33.6	23.4	7.1	39.7	25.1	7.1	44.1	30.4	7.1	25.5	18.9	30.6	20.7	36	26.1	15
31. Micro Imagem (Brazil)																		
EVO	CMOS	1, 2	–	–	–	36.73	24.35	5.41	42.8	30.49	5.41	–	–	30.02	19.95	36	25.99	19
FIT	CMOS	1, 2	–	–	–	36.73	24.35	5.41	42.8	30.49	5.41	–	–	30.02	19.95	36	25.99	19
32. Midmark (United States)																		
Intraoral Digital Sensor	CMOS	1, 2	–	–	–	37	24	–	43	30	–	–	–	–	–	–	–	14
33. Myray (Italy)																		
X-pod	CMOS	1, 2	–	–	–	38.9	24.9	5.3	41.9	30.4	5.7	–	–	–	–	–	–	20
Zen-X	CMOS	1, 2	–	–	–	38.9	24.9	5.3	41.9	30.4	5.7	–	–	–	–	–	–	20
Zen-X DCiS	Si-CMOS	2	–	–	–	–	–	–	43.4	29.5	5.2	–	–	–	–	35.1	24.7	–
Zen-X E	CMOS	1, 2	–	–	–	38.5	25	4.5	45	31.6	4.5	–	–	30.26	20.32	36.32	26.32	20
34. NewTom (Italy)																		
DCiS DIRECT.VISION	Si-CMOS	2	–	–	–	–	–	–	43.4	29.5	5.2	–	–	–	–	35.1	24.7	–
X-VS	CMOS	1, 2	–	–	–	38.9	24.9	5.3	41.9	30.4	5.7	–	–	–	–	–	–	20
X-VS E	CMOS	1, 2	–	–	–	36.8	25.4	4.5	41.9	30.4	4.5	–	–	30.26	20.32	36.32	26.32	20
35. Owandy Radiology (France)																		
Dsx 730 Évolution	CCD	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	21
Dsx 730 USB	CCD	1	–	–	–	40	25	4.5	–	–	–	–	–	–	–	–	–	21
One	CMOS	1, 2	–	–	–	38.6	24.7	5.2	43.2	30.8	5.2	–	–	30	20	34	26	20
Opteo	CMOS	1, 2	–	–	–	38.6	24.7	5.2	43.2	30.8	5.2	–	–	30	20	34	26	20
36. Planmeca (Finland)																		
Dixi2	CCD	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	19
Dixi3	CCD	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	19
ProSensor	CMOS	0, 1, 2	33.6	23.4	–	39.7	25.05	–	44.1	30.4	–	25.5	18.9	31.5	20.7	36	26.1	15
ProSensor HD	CMOS	0, 1, 2	33.6	23.4	–	39.7	25.05	–	44.1	30.4	–	25.5	18.9	30.6	20.7	36	26.1	15
37. PointNix (South Korea)																		
CDR PointNix	CMOS	1, 2	–	–	–	38.5	25	4.5	40	31	4.5	–	–	30	20	36	26	–
38. Ray Co (South Korea)																		
RIOSensor	CMOS	1, 2	–	–	–	39	25	–	42	30	–	–	–	30	20	34	26	20
39. Regam Medical Systems (Sweden)																		
Sens-A-Ray	CCD	1	–	–	–	42	29	7	–	–	–	–	–	26	17.3	–	–	–
40. Roson (China)																		
ROX-500	Photon-counting	1, 2	–	–	–	36.8	25.4	4.4	41.9	30.4	4.4	–	–	27	21	32	26.5	–
41. Saevo (Brazil)																		
Timex	CMOS	1	–	–	–	–	–	–	–	–	–	–	–	30	20	–	–	18.75

Table 2. Continued

Model	Technology	Size	Sensor size 0 (mm)			Sensor size 1 (mm)			Sensor size 2 (mm)			Active area 0 (mm)		Active area 1 (mm)		Active area 2 (mm)		Pixel size (μm)
			Length	Width	Depth	Length	Width	Depth	Length	Width	Depth	Length	Width	Length	Width	Length	Width	
42. Schick Technologies Inc. (United States)																		
CDR-APS	CMOS	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
CDR Wireless	CMOS	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	40
43. Sigma Digital X-Ray (United States)																		
BIO-RAY Medallion	CMOS	1, 2	–	–	–	36.8	25.4	4.8	42.9	31.3	4.8	–	–	30	20	33	25	18
44. Sirona (Germany)																		
Intraoral II	CCD	2	–	–	–	–	–	–	40.96	30.93	7	–	–	–	–	–	–	19.5
Sidexis	CCD	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	39
45. Soredex (Finland)																		
Digora Toto	CMOS	1, 2	–	–	–	37	24	–	43	31	–	–	–	30	20	36	26	–
46. Sota Imaging (United States)																		
Clio Prime	CMOS	1	–	–	–	41.82	30.5	–	–	–	–	–	–	35.92	25.82	–	–	–
47. Suni Medical Imaging Inc (United States)																		
Dr. Suni Plus	CCD	0, 1, 2	32.5	25.6	–	39.5	26	–	43.5	31.5	–	26.01	20.97	31	19.98	36	25.97	–
48. Trident Dental (Italy)																		
I-View Gold	CMOS	1, 2	–	–	–	36.8	25.4	4.8	42.9	31.3	4.8	–	–	30	20	38	26	–
I-View Silver	CMOS	1, 2	–	–	–	36.9	25.4	4.4	41.9	30.4	4.4	–	–	30	20	36	26	–
49. Trophy (France)																		
RVG 32000 ZHR	CCD	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
50. Vatech (South Korea)																		
EzSensor Classic	CMOS	1, 1.5, 2	–	–	–	36.8	25.4	4.8	42.9	31.3	4.8	–	–	30.01	20.01	35.99	25.99	–
51. Villa Sistemi Medicali (Italy)																		
Flash Dent	CCD	1	–	–	–	–	–	–	–	–	–	–	–	24	20	–	–	–
52. Visiodent (France)																		
RSV	CCD	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	22
RSV-HD Memory	CCD	1, 2	–	–	–	38.7	26.3	4.9	42.6	30.6	4.9	–	–	30	20	34	24	19
RSV-HD Viewireless	CCD	1, 2	–	–	–	38.7	26.3	4.9	42.6	30.6	4.9	–	–	30	20	34	24	19
RSV-HD USB	CCD	1, 2	–	–	–	38.7	26.3	4.9	42.6	30.6	4.9	–	–	30	20	34	24	19
RSV USB 3 +	CMOS	1, 2	–	–	–	36.73	24.35	–	42.8	30.49	–	–	–	30	20	36	26	19
RSV 5	CMOS	–	–	–	–	39.4	29.2	4.6	–	–	–	–	–	30	20	33	24	–
53. Woson (Brazil)																		
RAYIN	CMOS	1, 1.5, 2	–	–	–	38.5	25	4.5	45	31.6	4.5	–	–	30	20	36	26	–
54. Xpect Vision (China)																		
XLinearVision	Photon-counting	0.8, 1.5	–	–	–	–	–	–	–	–	–	21	21	30	25	–	–	–

CCD: charge-coupled device, CMOS: complementary metal-oxide semiconductor, DICOM: Digital Imaging and Communications in Medicine, Si-CMOS, single crystal direct conversion silicon.

Table 2. Continued

Model	Spatial resolution (lp/mm)		Contrast resolution (bits)	Sensor weight (g)			Connection interface	Image file size (MB)	Software	Manufacturer	Source
	Theorical	True		Size 0	Size 1	Size 2					
1. Acteon (France)											
SOPIX	25	12	–	–	–	–	USB	–	Sopro	Acteon	Manual
SOPIX PLUG-IN	25	12	–	–	60	64	USB	–	Sopro	Acteon	Manual
SOPIX^2	25	18	–	–	50	–	USB	–	Sopro	Acteon	Manual
SOPIX^2 PLUG-IN	25	18	–	–	60	64	USB	–	Sopro	Acteon	Manual
u.sense HD	25	12	–	–	–	–	USB	–	–	Acteon	Manual
2. Air Techniques (United States)											
SensorX	26.3	–	–	–	–	–	USB	–	VisionX, DBSWIN	Dürr Dental	Manual
3. Alerio (India)											
Mezzo	14	–	16	–	–	–	USB	–	–	–	Brochure
4. Apixia (United States)											
Dirigex Digital	27	20	8	–	–	–	USB	0.8-1.5	–	–	Brochure
5. Athlos (Finland)											
DC-Air	19	–	12	–	–	–	USB/Blue-tooth	–	–	ATHLOS	Manual
6. Carestream Dental (United States)											
RVG 142	5	–	12	–	65	75	USB	–	Sidexis 4	Carestream Dental	Manual
RVG 5100	27	–	12		120	140	USB	–	Kodak Dental	Carestream Dental	Manual
RVG 5200	5	–	12	–	65	75	USB	–	Sidexis 4	Carestream Dental	Manual
RVG 6100	27	–	12	–	120	130	USB	–	Kodak Dental	Carestream Dental	Manual
RVG 6200	5	–	12	–	65	75	USB	–	Sidexis 4	Carestream Dental	Manual
7. Cygnus Technologies (United States)											
CygnusRay MPS	–	–	–	–	–	–	–	–	–	–	Article
8. D700 (Brazil)											
D700 Slim	25	–	12	–	65	70	USB	–	–	Alliage	Manual
Digital Sensor	25	–	12	–	65	70	USB	–	–	Alliage	Manual
9. Dabi Atlante (Brazil)											
Eagle	25	–	12	–	65	70	USB	–	–	Alliage	Manual
Eagle S	25	–	12	–	–	–	USB	–	Eagle S	Alliage	Manual
New IDA	25	–	12	60	65	70	USB	–	–	Alliage	Manual
10. DE Healthcare Products (United States)											
Carina	20	–	14	–	–	–	USB	–	–	DE Healthcare Products	Manual
11. Dentium (South Korea)											
Clear	–	–	12	–	–	–	–	–	–	–	Brochure
12. Dentron Systems (United States)											
Dentron USB	26.3	20	12	–	–	–	–	–	–	–	Brochure
QuickRay	26.3	20	12	–	–	–	–	–	–	–	Website
UniRay HD	33.5	–	–	–	–	–	USB	–	–	–	Websti
13. Dentsply Sirona (United States)											
Schick 33	33.3	28	–	–	–	–	USB	2-8	CDR DICOM 5, Sidexis 2.6.1	Dentsply Sirona	Manual
Schick AE	33	28	–	–	–	–	USB	–	CDR DICOM	Dentsply Sirona	Manual
Schick Elite	16.7	–	–	–	–	–	USB	2-8	CDR DICOM 5, Sidexis 2.6.2	Dentsply Sirona	Manual

Table 2. Continued

Model	Spatial resolution (lp/mm)		Contrast resolution (bits)	Sensor weight (g)			Connection interface	Image file size (MB)	Software	Manufacturer	Source
	Theorical	True		Size 0	Size 1	Size 2					
Schick WiFi	16.7	–	–	–	50	–	USB/ wireless	–	–	Dentsply Sirona	Manual
Xios AE	33.3	28	–	–		–	USB	–	Sidexis 4	Dentsply Sirona	Manual
XIOS XG Select	16.7	16	–	–	50	–	USB	–	Sidexis 4	Dentsply Sirona	Manual
XIOS XG Supreme	33.3	28	–	–	50	–	USB	–	Sidexis 4	Dentsply Sirona	Manual
14. Dexis (United States)											
IXS	20	–	–	–	–	–	USB	–	–	–	Brochure
Platinum	20	–	–	–	–	–	USB	–	DEXray	Dexis	Manual
Titanium	25.6	–	–	–	–	–	USB	–	DTX Studio Clinic	–	Brochure
Ti2	20	–	–	–	–	–	USB	–	–	Dexis	Manual
15. DIGIMED (South Korea)											
DVS-200	16.8	–	12	–	–	–	USB	–	–	–	Brochure
16. Digital Doc (United States)											
Blü	25	20	12	–	–	–	USB	–	–	Trident Dental	Manual
17. Dürr Dental (Germany)											
VistaRay 7	26.3	20	16	–	–	–	USB	–	Dürr Dental	Dürr Dental	Manual
18. Eastman Kodak (United States)											
Kodak RVGui	27	–	8	–	–	–	–	–	Kodak Windows	–	Article
RVG 5000	14	–	–	–	–	–	–	–	–	–	Article
RVG 6000	20	–	–	–	–	–	–	–	–	–	Article
19. Fona (Italy)											
StarX Pro	25	20	–	–	–	–	USB	–	OrisWin DG Suite	–	Brochure
20. Fussen (China)											
F100	25	–	16	–	–	–	USB	–	–	Fussen	Manual
21. Gendex (United States)											
Visualix	22.5	–	8	–	–	–	USB	–	VixWin 2000	–	Article
VisualiX eHD	25.6	–	8, 16	–	–	–	USB	1.59-4.71	VixWin	Gendex	Manual
22. Genoray (South Korea)											
GIX 1	20	–	–	–	–	–	USB	–	–	–	Brochure
PortView	20	–	–	–	–	–	USB	–	–	–	Brochure
23. Hamamatsu Photonics K.K. (Japan)											
Apex	–	–	–	–	–	–	USB	–	Apteryx XrayVision	Hamamatsu Photonics K.K.	Manual
24. Handy (China)											
HDR-360	14	–	14	–	–	–	USB	–	HandyDentist	–	Website
HDR-460	14	–	14	–	–	–	USB	–	HandyDentist	–	Website
HDR-500	20	–	–	–	–	–	USB	–	–	–	Website
HDR-600	20	–	–	–	–	–	USB	–	–	–	Website
25. HDX Will (Germany)											
Dentra III	5	–	12	–	65	75	USB	–	Sidexis 4	Carestream Dental	Manual
26. ImageWorks (United States)											
EVA Select	26	20	12	–	–	–	USB	3.16-4.94	EVAsoft	–	Brochure

Table 2. Continued

Model	Spatial resolution (lp/mm)		Contrast resolution (bits)	Sensor weight (g)			Connection interface	Image file size (MB)	Software	Manufacturer	Source
	Theorical	True		Size 0	Size 1	Size 2					
27. Instrumentarium (Finland)											
Sigma	25	–	12	–	–	–	USB	1.38-2.565	CliniView	Instrumentarium	Manual
Sigma M	26.3	–	12	–	–	–	USB/ network	3.17-4.96	CliniView	Instrumentarium	Manual
Snapshot	26.3	–	12	–	–	–	USB	0.8-1.3	CliniView	Instrumentarium	Manual
28. Integra Medical (United States)											
ViperRay	7	–	–	–	–	–	–	–	Vipersoft 4.0	–	Article
29. J Morita (Japan)											
Megadixel	25	–	14	–	50	–	USB	–	–	–	Website
30. Kavo (Germany)											
KaVo ProXam iS	33	20	16	–	–	–	USB/ ethernet	–	Romexis	–	Brochure
31. Micro Imagem (Brazil)											
EVO	26	–	–	–	–	–	USB	–	–	Micro Imagem	Manual
FIT	20	–	–	–	–	–	USB	–	–	Micro Imagem	Manual
32. Midmark (United States)											
Intraoral Digital Sensor	35.7	12	–	–	–	–	USB	–	Progeny	Midmark	Manual
33. Myray (Italy)											
X-pod	25	–	14	–	–	–	USB	–	iCapture	Cefla	Brochure
Zen-X	25	–	14	–	–	–	USB	–	iCapture	Cefla	Brochure
Zen-X DCiS	–	–	–	–	–	–	USB/ wireless	–	iCapture	Cefla	Brochure
Zen-X E	25	–	16	–	–	–	USB	–	iCapture	Cefla	Brochure
34. NewTom (Italy)											
DCiS DIRECT.VISION	–	–	–	–	–	–	USB/ wireless	–	iCapture	Cefla	Brochure
X-VS	25	–	14	–	–	–	USB	–	iCapture	Cefla	Brochure
X-VS E	25	–	16	–	–	–	USB	–	iCapture	Cefla	Brochure
35. Owandy Radiology (France)											
Dsx 730 Évolution	9	–	–	–	–	–	–	–	Owandy/Julie RV2000	–	Article
Dsx 730 USB	23.8	–	12	–	–	–	–	–	QuickVision	–	Brochure
One	25	–	14	–	–	–	USB	–	QuickVision	Owandy Radiology	Manual
Opteo	25	–	14	–	–	–	USB	–	QuickVision	Owandy Radiology	Manual
36. Planmeca (Finland)											
Dixi2	26	–	8	–	–	–	–	0.647	Dimaxis Pro 3.01	–	Article
Dixi3	26	–	–	–	–	–	–	–	–	–	Article
ProSensor	33	16	–	–	–	–	USB	–	–	–	Manual
ProSensor HD	33	20	16	–	–	–	USB	–	Planmeca Romexis, Planmeca ProSensor	–	Manual
37. PointNix (South Korea)											
CDR PointNix	25	20	16	–	–	–	USB	–	–	–	Website
38. Ray Co (South Korea)											

Table 2. Continued

Model	Spatial resolution (lp/mm)		Contrast resolution (bits)	Sensor weight (g)			Connection interface	Image file size (MB)	Software	Manufacturer	Source
	Theorical	True		Size 0	Size 1	Size 2					
RIOSensor	25	–	–	–	–	–	USB	–	–	–	Brochure
39. Regam Medical Systems (Sweden)											
Sens-A-Ray	10	–	8	–	–	–	–	–	–	–	Article
40. Roson (China)											
ROX-500	25	14	16	–	–	–	USB	–	–	–	Website
41. Saevo (Brazil)											
Timex	25	–	24	–	87.6	–	USB	–	Handy Dentist	Alliage	Manual
42. Schick Technologies Inc. (United States)											
CDR-APS	12.5	–	8	–	–	–	–	0.564	CDR for DICOM	–	Article
CDR Wireless	–	–	–	–	–	–	–	–	–	–	Article
43. Sigma Digital X-Ray (United States)											
BIO-RAY Medallion	25	20	–	–	–	–	USB	–	–	–	Website
44. Sirona (Germany)											
Intraoral II	13	–	8	–	–	–	–	–	–	–	Article
Sidexis	12.5	–	8	–	–	–	–	0.576	Sirona Sidexis XG	–	Article
45. Soredex (Finland)											
Digora Toto	26.3	–	12	–	–	–	USB	0.8-5.1	Digora for Windows, Soredex Twain	–	Brochure
46. Sota Imaging (United States)											
Clio Prime	20	–	14	–	–	–	–	–	SOTA Image Dental	–	Brochure
47. Suni Medical Imaging Inc (United States)											
Dr. Suni Plus	22	–	12	–	–	–	USB	0.43	Prof. Suni Software	–	Brochure
48. Trident Dental (Italy)											
I-View Gold	25	20	–	–	–	–	USB	–	Deep-View	–	Brochure
I-View Silver	25	20	16	–	–	–	USB	–	Deep-View	–	Brochure
49. Trophy (France)											
RVG 32000 ZHR	–	–	8	–	–	–	–	–	Sidexis 4	–	Article
50. Vatech (South Korea)											
EzSensor Classic	33.78	–	–	–	–	–	USB	–	EzSensor HD	Rayence Co.	Manual
51. Villa Sistemi Medicali (Italy)											
Flash Dent	3.8	–	–	–	–	–	–	–	–	–	Article
52. Visiodent (France)											
RSV	6	–	–	–	–	–	–	–	RSV Imaging XP	–	Article
RSV-HD Memory	26.3	20	12	–	–	–	USB/ wireless	–	–	–	Brochure
RSV-HD Viewireless	26.3	20	12	–	–	–	USB wireless	–	–	–	Brochure
RSV-HD USB	26.3	20	12	–	–	–	USB	–	–	–	Brochure
RSV USB 3+	26.3	20	–	–	–	–	USB	–	–	–	Brochure
RSV 5	25	–	12	–	–	–	USB	–	–	–	Brochure
53. Woson (Brazil)											
RAYIN	25	–	–	–	–	–	USB	–	–	–	Website
54. Xpect Vision (China)											
XLinearVision	14	–	16	–	–	–	USB/ wireless	–	–	–	Website

identified: 0, 1, 2, 3, 4, 4C, and 5. Most PSP-based systems (53.3%) offered sizes 0, 1, 2, 3, and 4. Pixel sizes ranged from 12.5 to 64 μm. Theoretical spatial resolution ranged from 6.3 to 40 lp/mm, true spatial resolution from 7.1 to 23.8 lp/mm, and contrast resolution from 8 to 16 bits. Minimum scanning times ranged from 4 to 20 seconds. Scanner weights ranged from 1.5 to 21 kg, with dimensions varying from 12 to 49.3 cm in width, 10.4 to 63 cm in height, and 15.1 to 41 cm in depth. Laser wavelengths ranged from 635 to 1000 nm. File sizes ranged from a minimum of 0.6 MB to a maximum of 58 MB. Twenty-one different viewer software applications were identified. The most frequently missing data were the resulting image file size, absent in 28 systems (62.2%). Nine systems were manufactured by a company different from the production company. Detailed technical specifications for the PSP-based systems are provided in Table 3.

Recommendations for standardised reporting of technical specifications

Thirty-one important technical specifications, along with their corresponding details, were identified and organised under 6 categories: general, sensor, psp plate, psp scanner, resolution, and visualisation (Table 4).

Discussion

The introduction of the first intraoral digital radiographic system in 1987 marked a significant milestone in dental medicine. Featuring a sensor-based image receptor named Radio Visiography (RVG) and manufactured in France,[16] this innovation set the stage for digital systems to gradually replace analogue film-based imaging worldwide. In this study, 105 sensor-based and 45 PSP-based systems were identified and assessed, resulting in a total of 150 intraoral digital radiographic systems.

A clear technological evolution has occurred in dental imaging, although the core imaging mechanism in PSP systems has remained largely unchanged across brands. The primary difference between sensor- and PSP-based systems is that sensor systems transmit images directly to a computer, whereas PSP systems require scanning.[2] Sensor-based systems generally offer a smaller active area relative to their overall size and tend to be more robust, though they can be less comfortable for patients.[17,18] The choice of system depends on clinical workflow; for instance, specialties such as endodontics benefit from the speed of sensor-based systems, while PSP systems or Wi-Fi-enabled sensors may be more appropriate for practices with multiple simultaneous users. Additionally, some PSP systems offer size-4 plates designed for occlusal radiographs, which are useful in oral surgery and trauma cases.

Although this study aimed to include as many intraoral digital radiographic systems as possible, some discontinued models were unavailable on official webpages, suggesting that the total number of systems may exceed 150. This underscores the need for manufacturers to maintain accessible information on outdated models. Similar challenges were noted in a previous study on CBCT devices, which identified 279 models.[19] In contrast to digital systems, CBCT development has been more dynamic, with ongoing updates to specifications such as field of view and voxel sizes.

Sensor-based systems utilise various technologies including CCD, CMOS, photon-counting, and Si-CMOS. CMOS sensors, favored for their cost efficiency, now dominate the market (76.2% in this study).[20] Direct-conversion sensors, although recently introduced and claiming higher image quality, still lack extensive scientific evaluation. PSP systems, while more economical per plate, require an additional scanner, thereby increasing overall costs. Technological advancements continue to influence the pricing of both types of systems.

Spatial resolution, expressed in line pairs per mm (lp/mm), directly affects image quality and varies across systems.[21-24] Sensor-based systems typically offer higher theoretical resolutions; however, the true clinical resolution depends on factors such as focal spot size and projection geometry, which manufacturers often do not disclose. Similarly, contrast resolution (bit depth) impacts diagnostic performance and varies between systems, with sensor-based systems displaying a broader range (8 to 24 bits) than PSP systems (8 to 16 bits).[2,23,25]

Sensor-based systems showed size variations across brands, with sizes 1 and 2 being the most common. Size 1.5 (measuring approximately 36.8-39.5 mm in length and 25-29.63 mm in width) was found in the Carina, UniRay HD, EzSensor Classic, RAYIN, and XLinearVision systems; this size was introduced to provide a larger active area than size 1 while offering greater comfort than size 2. PSP-based systems primarily featured plate sizes 0, 1, 2, 3, and 4. Size 4C, which represents a fusion of 2 size 3 plates for occlusal imaging, was noted in the Digora Optime DXR-50 001, Express, Express Origo, ClearVision CR, Owandy CR², ProScanner, ProScanner 2.0, Scan eXam, and Scan eXam One systems. Standard receptor dimensions are 22 × 35 mm (size 0), 24 × 40 mm (size 1), 31 × 41 mm (size 2), 27 × 54 mm (size 3), and 57 × 75 mm (size 4), with size 4 being exclusive to PSP systems. One unique sensor size, 0.8, mea-

Table 3. Technical specifications of the 45 photostimulable phosphor (PSP)-based digital intraoral radiographic systems as a function of the 22 brands and their countries

Model	PSP size	Pixel size (μm)	Spatial resolution (lp/mm)		Contrast resolution (bits)	Scanner						Connection interfaces	Image file size (MB)	Software	Manufacturer	Source
			Theoretical	True		Minimum scanning Times (s)	Weight (kg)	Width (cm)	Height (cm)	Depth (cm)	Laser wavelength (nm)					
1. Acteon (France)																
PSPIX 2	1, 2	25	20	20	14	–	2.6	15.4	20.5	19.4	–	LAN	–	Sopro Imaging	–	Manual
2. Air Techniques (United States)																
ScanX Classic View	0, 1, 2, 3, 4	12.5	40	–	16	16	21	38	63	41	635	Wi-Fi, LAN	0.6-19.65	DBSWIN, VisionX	Dürr Dental	Manual
ScanX Duo Touch	0, 1, 2, 3, 4	21, 50	40	–	16	8	8	23.4	37.9	29.3	635	USB, Wi-Fi, LAN	0.6-5.6	DBSWIN, VisionX	Air Techniques	Manual
ScanX Intraoral View	0, 1, 2, 3, 4	12.5	40	–	16	16	19.5	38	45	41	635	Wi-Fi, LAN	0.6-19.65	DBSWIN, VisionX	Dürr Dental	Manual
ScanX Swift	0, 1, 2	21, 50	40	–	16	8	6.5	22.6	23.4	24.4	635	USB	0.6-5.6	DBSWIN, VisionX	Air Techniques	Manual
ScanX Swift View	0, 1, 2, 3, 4	12.5, 50	40	–	16	8	6.8	22.6	27.5	24.3	635	Wi-Fi, LAN	0.6-19.65	DBSWIN, VisionX	Dürr Dental	Manual
ScanX Swift View 2.0	0, 1, 2, 3, 4	12.5, 50	40	–	16	4	5.3	21.1	27.3	25.8	639	LAN	0.62-55.45	VisionX	Dürr Dental	Manual
3. Apixia (United States)																
Dirigex PSP	0, 1, 2, 3	–	17	–	–	–	3.6	18.3	13.8	25.8	–	USB	–	TWAIN	–	Brochure
EXL PSP	0, 1, 2, 3, 4	–	22	–	–	10	5.1	21.4	17	26.6	–	USB, Network	–	TWAIN	–	Brochure
EXM PSP	0, 1, 2, 3	–	22	–	–	10	3.7	19.6	14	21.3	–	USB, Network	–	TWAIN	–	Brochure
4. Carestream (United States)																
CS7200	0, 1, 2	–	8, 14, 17, 19	–	–	8	3.5	13	27	25	635-660	USB	–	–	Carestream	Manual
CS7400	0, 1, 2, 3, 4	–	20	8, 10	–	–	18	48	24	38	635-650	USB	–	CS Imaging	–	Brochure
CS7600	0, 1, 2, 3, 4	–	8, 14, 18	–	–	–	6	23.7	26.7	26	635-660	USB, Network	–	CS Imaging	Carestream	Manual
5. Cruxell (South Korea)																
CRUXCAN MAX	0, 1, 2, 3, 4, 5	–	–	–	–	–	–	–	–	–	–	–	–	–	–	Website
CRX-1000	0, 1, 2, 3	25, 50	–	–	16	–	3.0	14.1	23.3	19.2	638	Network	–	CRUXVIEW	–	Website
6. Dabi Atlante (Brazil)																
Eagle PS	0, 1, 2, 3	–	–	–	–	–	5.3	17.5	28.5	24	–	USB	–	Eagle.PS	Alliage	Manual
7. Dentsply Sirona (Germany)																
Xios Scan	0, 1, 2, 3	23, 30	17, 22	–	16	–	7.3	16.3	28.6	36.3	660	LAN	–	SIDEXIS	Dentsply Sirona	Manual
8. Dexis (United States)																
Scan eXam	0, 1, 2, 3, 4C	30, 60	16.7	–	14	–	10.3	21.5	19.6	38.2	–	USB, Network	1.44-5.49	CLINIVIEW	–	Brochure
Scan eXam One	0, 1, 2, 3, 4C	30, 60	17	–	16	–	4.0	23.3	16.8	32.8	–	USB, Network	1.08-2.32	CLINIVIEW	–	Brochure
9. Dürr Dental (Germany)																

Table 3. Continued

Model	PSP size	Pixel size (μm)	Spatial resolution (lp/mm)		Contrast resolution (bits)	Scanner						Connection interfaces	Image file size (MB)	Software	Manufacturer	Source
			Theoretical	True		Minimum scanning Times (s)	Weight (kg)	Width (cm)	Height (cm)	Depth (cm)	Laser wavelength (nm)					
VistaScan Combi View	0, 1, 2, 3, 4	12.5, 20, 25, 50	6.7, 10, 20, 25, 40	–	16	14	21	38	63	41	635	USB, Network	0.62-55.45	DBSWIN, VistaSoft	Dürr Dental	Manual
VistaScan Mini Easy	0, 2	12.5, 20, 25, 50	10, 20, 25, 40	–	16	6	6.5	22.6	23.4	24.3	635	USB, Network	0.65-10.4	DBSWIN, VistaSoft	Dürr Dental	Manual
VistaScan Mini Easy 2.0	0, 1, 2, 3, 4	12.5, 20, 25, 50	6.7, 10, 20, 25, 40	–	16	4	5.1	21.1	24.9	25.8	639	USB, Network	0.62-55.45	VistaSoft	Dürr Dental	Manual
VistaScan Mini View	0, 1, 2, 3, 4	12.5, 20, 25, 50	10, 20, 25, 40	–	16	4	7	22.6	27.5	24.3	635	USB, Network	0.62-55.45	VistaSoft	Dürr Dental	Manual
VistaScan Mini View 2.0	0, 1, 2, 3, 4	12.5, 20, 25, 50	6.7, 10, 20, 25, 40	–	16	4	5	21.1	27.3	25.8	639	LAN, WLAN	0.62-55.45	VistaSoft	Dürr Dental	Manual
VistaScan Nano Easy	0, 1, 2	12.5, 30, 50	16.7	–	16	13	4	16.7	23.1	21.6	635	Network	0.62-3	VistaSoft	Dürr Dental	Manual
VistaScan Perio Plus	0, 1, 2, 3, 4	12.5, 20, 25, 50	10, 20, 25, 40	–	16	6	12.5	31	52.3	29.3	635	USB, Network	0.62-58	DBSWIN	Dürr Dental	Manual
VistaScan Ultra View	0, 1, 2, 3, 4	–	22, 40	–	16	8	8	25.1	39.1	29.2	635	Network	0.62-58	VistaSoft	Dürr Dental	Manual
10. Fussen (China)																
F200	0, 1, 2, 3	42	12	–	14	–	5.2	16.7	26	32.5	–	USB	–	Dental X	–	Brochure
F220	0, 1, 2, 3	30	17	–	14	4.5	–	–	–	–	–	USB	–	Dental X	–	Brochure
11. Gendex (United States)																
DenOptix QST	0, 1, 2, 3, 4	–	–	–	–	–	16	49.3	39.4	27.4	–	USB	–	VixWin	Gendex	Manual
12. Handy (China)																
HDS-500	0, 1, 2, 3	35	7	–	14	1.5	5	–	–	–	660	USB	–	Handy Dentist	Handy	Manual
13. Instrumentarium Dental (Finland)																
Express	0, 1, 2, 3, 4C	30, 60	16.7	–	14	–	10.3	21.5	19.6	38.2	–	USB, Network	1.44-5.49	CLINIVIEW	Instrumentarium	Manual
Express Origo	0, 1, 2, 3, 4C	30, 60	16.7	–	16	–	3.7	23.3	16.8	32.8	–	Network	1.4-5.49	CLINIVIEW	Instrumentarium	Manual
14. Kavo (Germany)																
ProXam iP	0, 1, 2	30	16.7	12	16	20	4	16.7	23.1	21.6	–	Network	–	Romexis	–	Brochure
15. Midmark (United States)																
ClearVision CR	0, 1, 2, 3, 4C	35, 64	14.3	–	16	4.1	5.5	12	26.5	31.8	658	USB	–	Progeny	Midmark	Manual
16. Myray (Italy)																
HyScan	0, 1, 2, 3	30	17	–	16	4	3.8	13.3	17.6	26.4	–	LAN, Network	–	iRYS	Cefla	Brochure
17. NewTom (Italy)																
X-PSP	0, 1, 2, 3	30	17	–	16	4	5.6	16.3	22.4	29	–	LAN, Network	–	iCapture	Cefla	Brochure
18. Owandy Radiology (France)																
Owandy CR2	0, 1, 2, 3, 4C	30	17	–	16	4	4.25	15.1	10.4	28.6	400	USB, Network	–	QuickVision	–	Brochure

Table 3. Continued

Model	PSP size	Pixel size (μm)	Spatial resolution (lp/mm)		Contrast resolution (bits)	Scanner										
			Theoretical	True		Minimum scanning Times (s)	Weight (kg)	Width (cm)	Height (cm)	Depth (cm)	Laser wavelength (nm)	Connection interfaces	Image file size (MB)	Software	Manufacturer	Source
19. Planmeca (Finland)																
ProScanner	0, 1, 2, 3, 4C	35, 64	-	-	16	-	5.5	12	26.5	31.8	658	USB	-	Romexis	3D Imaging & Simulations Corp.	Manual
ProScanner 2.0	0, 1, 2	30	16.7	12	16	20	4	16.7	23.1	21.6	635	Network	1.8-3.0	Romexis	Dürr Dental	Manual
20. Ray Co (South Korea)																
RIOScan	0, 1, 2, 3, 4	-	9, 16, 21	-	14	5	3.5	17	26	27.8	-	Network	-	PACS Viewer	-	Brochure
21. Soredex (Finland)																
Digora	1, 2	-	6.3, 7.1	-	8	-	-	-	-	-	-	-	-	-	-	Article
Digora Optime DXR-50 000	0, 1, 2, 3	40, 64	12.5	10	14	4.3	-	22.1	19.1	39.4	-	Network	-	-	Soredex	Manual
Digora Optime DXR-50 001	0, 1, 2, 3, 4C	30, 60	16.7	-	16	-	3.5	22.7	15.2	30.8	-	Network	1.44-5.49	-	Soredex	Manual
22. Trident Dental (Italy)																
Reader	0, 1, 2, 3	35	14	-	16	10	-	17	30	19	400	USB	-	Deep-View	-	Brochure

LAN: local area network, PSP: photostimulable phosphor.

sures 21 × 21 mm. Sensors, with thicknesses ranging from 4.4 to 8.6 mm, can be challenging to position in the mouth and require training to ensure proper technique. Despite gradual reductions in sensor thickness over time, the need for specific holders remains a disadvantage compared to PSP systems.

While it is challenging to verify that the technical specifications provided by manufacturers are entirely accurate, the primary aim of this manuscript was not to assess precision directly, as such an evaluation would require a different study design. Instead, this study addresses a critical gap in the literature by offering a comprehensive and standardised analysis of digital radiographic system specifications. This contribution is important both for clinical practice and for advancing industry standards. The data were collected with scientific rigor, offering valuable insights into a field that is integral to the daily practice of dentists worldwide. To the best of the authors' knowledge, there is currently no overview of intraoral imaging systems, despite the long-standing and frequent use of intraoral X-rays in dentistry. Thus, an up-to-date, technically sound overview is essential.

Previous studies have reported satisfaction with digital systems among 80% of Norwegian dentists,[26] 90% of Indian dentists,[27] 91% of Swedish dentists,[28] 96% of Dutch dentists,[29] and 96.4% of Brazilian dentists.[30] A key advantage of digital systems over film-based ones is reduced processing time, with 65% of Indian dentists[27] and 79% of Norwegian dentists[26] reporting time savings. Regarding image quality, 55% of Swedish dentists,[28] 66.7% of Norwegian dentists,[26] 81.8% of Brazilian dentists,[30] and 90% of Indian dentists[27] stated that digital systems provided better image quality than film-based systems. However, 50% of Norwegian dentists[26] and 86% of Swedish dentists[28] experienced technical issues with digital intraoral radiographic systems.

This study aimed to appraise and summarise both current and historic intraoral digital radiographic systems and their features, but it encountered limitations. Many systems lacked essential technical specifications, such as spatial resolution, contrast resolution, and pixel size. Regarding pixel size, production companies often did not clarify whether the measurement referred to the radiation-sensitive sensor element (dexel) or the smallest discernible image unit. The absence of standardisation in manufacturers' documents prompted the authors to propose recommendations for reporting technical specifications (Table 4). These recommendations are intended to enhance transparency, facilitate comparisons, support informed purchasing decisions, and advance research. Extracting technical specifications was

Table 4. Recommendations for standardised reporting of technical specifications of intraoral digital radiographic systems

Category	Technical specification	Details
General	Brand	–
	Branding country	–
	Model	–
	Version	–
	Release year	format: yyyy
	Manufacturer	
	Manufacturing country	–
Sensor	Technology	ex: CCD, CMOS, photon-counting, Si-CMOS
	Signal conversion technology	direct or indirect
	Detector element size	in micrometres
	Surface dimensions	width × height in millimetres
	Active area dimensions	width × height in millimetres
	Thickness	in millimetres
	Weight	in grams
	Cable length	in meters
	Connection interface	ex: USB, Wireless, Bluetooth
PSP plate	Surface dimensions	width × height in millimetres
	Thickness	in millimetres
	Weight	in grams
PSP scanner	Dimensions	width × height × depth in centimetres
	Weight	in kilograms
	Laser wavelength	in nanometres
	Connection interface	ex: USB, LAN, Network, Wi-Fi
	Scanning time	in seconds
Resolution	Theoretical spatial resolution	in line pairs per millimetre
	Contrast resolution	in bits
	Pixel size	in micrometres
Visualisation	Proprietary software	–
	Minimum image file size	in bytes
	Maximum image file size	in bytes
	Image file type	ex: DICOM, JPEG, TIFF

CCD: charge-coupled device, CMOS: complementary metal-oxide semiconductor, DICOM: Digital Imaging and Communications in Medicine, LAN: local area network, PSP: photostimulable phosphor, Si-CMOS: single crystal direct conversion silicon.

further complicated when systems were manufactured by companies different from the production brands, as well as by changes in trade names. All data presented in the tables were extracted solely from identified documents; in some well-known systems, manufacturer details were omitted and only the brand names were provided. The inability to determine release years also hindered attempts to correlate commercial success with technical specifications or to observe their evolution.

It is important to consider local and international regulations when implementing radiation-generating devices in dental practice, as there are significant differences in mandatory labelling requirements and examination regulations across countries. Different countries may have varying guidelines on dose limits, device labelling, and safety protocols. Harmonisation of these regulations could improve safety practices and the efficiency of dental radiographic examinations. As a next step, the development of an international database or registry is recommended, where manufacturers could disclose standardised technical specifications. Additionally, educational initiatives are needed to enhance clinicians' understanding of digital system technologies, thereby enabling more informed decision-making. The list of digital systems presented in this study will be updated along with their technical specifications every 5 years to ensure alignment with the latest technologies, and

similar studies focusing on X-ray devices will be conducted.

In conclusion, this report identified 150 digital radiographic systems, revealing wide variability in their technical specifications and a lack of standardised reporting protocols. The comprehensive summary and recommendations for consistent documentation presented herein can assist professionals in making informed decisions and encourage manufacturers and production companies to adopt uniform reporting standards aligned with local regulatory frameworks.

Conflicts of Interest: None

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