International Journal of
INTELLIGENT SYSTEMS AND APPLICATIONS IN ENGINEERING
IJISAE
ISSN:2147-6799 www.ijisae.org Original Research Paper

Digitization in Dentistry: A Conceptual Framework for Digital Dental Technologies and Dental Informatics in Dental Practice

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Submitted: 26/04/2023 **Revised**: 26/06/2023 **Accepted**: 05/07/2023

Abstract: Although the scientific literature has previously described and identified the impact of digital dental technologies and dental informatics based on clinical outcomes and adoption in different contexts, the conceptual framework that covers most of these technologies and informatics has not been identified. In addition, studies on digital dental technologies (DDT) and dental informatics (DI) usually report clinical outcomes and benefit outcomes separately for each technology, not integrated into a single study for all digital technologies in dental practice. Knowing the clinical outcomes, patient satisfaction, and benefits-related impacts of the adoption of DDT and DI could provide useful information for stakeholders in the adoption of these technologies. The purpose of this literature review was to identify digital dental technologies (DDT) and dental informatics (DI) and investigate the benefits and impacts of these technologies in dental practice. The study has provided a conceptual framework for digital dental technologies and dental informatics that have been adopted in dental practices. The conceptual framework has covered most dental informatics systems and digital dental technologies. There are several benefits to using dental digital technology in dental services, including prevention, treatment planning, analysis, clinical diagnosis, treatment, maintenance, research, and education, as well as virtual treatments. That leads to increased patient satisfaction, improved results, safety, productivity, and duration of treatment. The implementation of digital technology in dental practice carries several benefits. Informatics and digital technologies in each sub-specialty of dentistry give various options and are strong enablers to carry out dentistry more effectively and safely in general.

Keywords: *Dental informatics (DI); digital dental technologies (DDT); electronic health records (EHR); computer-aided design and manufacturing (CAD/CAM); and cone-beam computed tomography (CBCT)*

1. Introduction

The rapid advancement of digital technologies has resulted in a vast range of concepts and research endeavors aimed at fitting developmental trajectories within society [1, 2, 3]. The cutting-edge progress in technology, including social media tools and information technology (IT), has led to better communication and collaboration between organizations and individuals [4]. In fact, these emerging technological advancements can facilitate sustained expansion effectively. The advent of digital technologies has revolutionized conventional industrial manufacturing, service delivery, policy decision-making, and public participation, while concurrently impacting digital health management within the dentistry segment. The emergence of novel methodologies as a result of technological progress has prompted the government and many private corporations to adopt these technological advancements [5].

Nonetheless, the setup of these IT platforms often requires significant resources. Hence, it is imperative to apply innovative technology that optimizes organizational processes through interactive communication with various stakeholders. Technological advancements effectively promote sustainable development by offering a variety of stakeholders real-time opportunities to express their concerns about policy matters. This much sought-after progress in IT facilitates the integration of digital data. New technology serves as a significant social and economic catalyst that can enhance technological usability, economic prosperity, and political engagement. The impact of cutting-edge technology is evident in the transformation of work, learning, and socialization patterns. The progressive advancements in digital data bring about a departure from established norms and stimulate significant gains in both productivity and economic expansion in the IT segment.

The term "Industry Revolution 4.0" (IR4.0) refers to the subsequent industrial change that new digital industrial technologies will bring about. The concept of IR4.0 has reshaped societal structural foundations and attracted interest in many countries. The mid-20th century has witnessed a great digital revolution with the advent of several radically disruptive technologies, such as 3D printing, blockchain, artificial intelligence (AI), and robots. The impact of new interactive technical breakthroughs is substantial because changes have been occurring on a wide

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and varied scale. Given that IR4.0 is developing and spreading within the business sector, many countries are trying to keep up with cutting-edge technological progress. Meeting the present digital demands reflects the sharing of digital data and the interconnectedness of manufacturing stakeholders, which open new vistas for technology availability. Many of these digitized devices offer novel means of satisfying individual needs and having a better connection with suppliers.

The field of informatics focuses on the gathering, retention, and application of data in a certain context [6, 7]. The foundation of this field is in a particular domain, setting it apart from both information science and computer science. The field of informatics concentrates on information as opposed to technology, which is viewed as an instrument to optimize information usage. Upon initiating the fundamental theorem of informatics, Friedman (2009) asserted that the main focus of informatics lies in leveraging technology to improve human cognitive abilities instead of developing systems that replicate or supplant human expertise [8]. Dental informatics is a burgeoning subfield of biomedical informatics that leverages computer and information science to advance dental practice, research, education, and management [9, 10]. A common misconception among individuals is that dental informatics is synonymous with the scarce use of computers, particularly IT. The field of informatics is concerned with investigations into information instead of computing technology. Hence, this present study employs several methodologies derived from various academic disciplines, including information science, computer science, cognitive science, and telecommunications. Advancements in the realm of informatics have been transformed into computer-based applications or apparatus, thus giving rise to the domain of IT. Digital devices like intra- and inter-oral cameras, face scanners, and cone-beam computed tomography (CBCT), which uses low-dose radiation instead of regular CT radiation, show that dental informatics has come a long way. On top of those, there is software for intelligent processing, such as computer-aided design and manufacturing (CAD/CAM) prosthetic design and planning software, as well as software for guided implant surgery. The advent of new attractive materials, modern production, and prototyping technologies, such as milling machines and 3D printers, has assisted this shift even more.

The Hospital Information System (HIS) is a complete and integrated information system that manages the administrative, financial, and clinical aspects of a hospital [11]. The HIS is a comprehensive software program that integrates patient information and can be used to send and exchange detailed patient information across wards and other medical facilities in a rapid, effective, and affordable manner. The processes of care delivery based on HIS, according to Khalifa (2014) [12], are a significant component of the healthcare system. As one of the most typical computer systems developed to aid healthcare services, HIS was defined by Farzandipour et al. (2011) [13] as a system that houses administrative and health information in vast computerized databases designed largely for communication. They added that HIS refers to a procedure executed in an organization based on IT to facilitate the user community. Many user groups (e.g., doctors, nurses, administrators, managers, and researchers) make up the user community within the healthcare industry.

Some benefits of using digital dental technology in dental services are its facilitation in treatment planning, analysis, and diagnosis, as well as virtual treatments, which allow both patients and dental professionals to see the outcome before the actual treatment [14]. A case study, for example, reported the positive effect of digital dental implant rehabilitation on treatment planning and execution. Digital dentistry coordinates all phases of the treatment procedure to minimize the risks and issues associated with dental implant placement and prosthetics for patients. While costs are reduced due to fewer clinical visits, communication between doctors and dental labs improves [15]. To assist all stakeholders in streamlining the business process using a single platform of digital technology in dentistry, a model for the adoption of digital dentistry was developed in Tehran. Known as DICOM, the document file in the digital medical field can be shared on a global scale to advance the practice of dentistry by facilitating the diagnosis, treatment, and maintenance of outcomes. Based on cloud technology, the platform is universal and enhances the dental business based on global resources [16].

2. Key Digital Technology and Dental Informatics

One of the most integral shifts that the field of dentistry has witnessed in the 21st century refers to the transition from a system that is dentist-centered to one that is patient-centric [17]. The provision of quality healthcare has been the subject of persistent concentration and evaluation. Conventional methods are substituted with advanced technology to attain the best possible outcomes. This not only improves access to treatment but also fosters a more positive interaction between medical professionals and their patients. Despite the readily available information retrievable to date, the sheer volume of options may be overwhelming. Technological advancement has an impact on changes in the healthcare system. Modern scientific methodologies should be adopted in a way that is well thought out, evidence-based, and open and accessible to all to fully realize their potential for revealing novel disease pathways and providing a new stance on long-held views.

Ascertaining optimal health necessitates discoveries in fundamental research work, the initiation of clinical therapies, and the dissemination of these discoveries to populations with wide-ranging needs. Basic, translational, clinical, and implementation, as well as health services and policies, are some research areas that are needed to optimize the healthcare system. In order to find effective treatments for dental caries and periodontal disease, craniofacial disorders, oral and oropharyngeal cancers, pulpitis, dysfunctional salivary glands, temporomandibular joints, mucosal problems, and other dental illnesses, it is important to both find and apply new information. Support systems, a committed, varied, and highly educated staff, and sustainability in the process of revising and reevaluating existing knowledge are vital for fundamental science, technological innovation, and implementation science to realize the listed goals.

3. Digital Dentistry

Digital dentistry refers to the many technological advances in dental care that make the processes of comprehensive communication, written documentation, plan implementation, and delivery easier through a single platform based on computer information systems ("Emerging Science and Promising Technologies to Transform Oral Health," 2021) [18]. Digital dentistry is crucial for the overall student experience as well as for research and new developments in dentistry education. Dental education includes vast technologies, such as digital dental microscopes, virtual pathology, digital X-ray imaging, dental machines, robotic patients, and simulation solutions [19].

The vast adoption of digital technology in the dentistry field may be traced back to the early 1990s with the development of digital radiography, intra-oral scanning, and CEREC crowns [20]. The advent of CBCT ushered in a new era of enthusiasm, mainly because its 3D images of the craniofacial region offer novel benefits in both diagnosis and treatment. A new age of success in clinical dentistry was witnessed with the convergence of incremental advances in hardware, software, and materials during the early 2000s [21]. Restoration with extraordinary dimensional and aesthetic integrity can be realized in a single sitting, chairside, in the comfort of the patient's home. In terms of therapeutic efficiency and patient safety, guided implant procedures are a clear winner. Meanwhile, prosthodontics has undergone a revolutionary transformation due to the advent of digital technologies.

4. Dental Informatics

The term "informatique" was first derived from French speakers in the 1960s. Its origins are in applied information science, which is linked with the dissemination of scientific or technological knowledge as well as the creation of more effective systems and methods. Later, the Soviets introduced "Informatika" as a subfield of the social sciences. The US continues to refer to it as "computer science," but the French view it as applied computer science. "Informatics" turned into a separate idea in the 1960s (Collen, 1995). In the early 1970s, "medical informatics" made its debut across English-speaking countries. Its origins may be traced back to France, where the field of medical informatics was established. The term "dental informatics" first appeared in a journal in 1986, and MEDLINE indexed it [22].

Dental informatics is a subfield of medical informatics that concentrates on information, communication, application technology, and information systems that revolve around dentistry [23, 24]. It incorporates the management of dental practices, the operation of dental clinics, and the scheduling of dental appointments. E-mail, internet search engines, and the use of online technology for diagnosis and medication are the means of communication. The documentation demands of dentists are highly varied and heavily rely on a variety of circumstances, including a patient’s character and clinical state. In the practice setting, dentists seek easy access to knowledge on various subjects. Easy data retrieval is highly beneficial to patients in terms of diagnosis and therapy.

Largely untapped, dental informatics has great potential to enhance aspects of management, research endeavors, teaching, and clinical treatment. This industry deploys computer science and information science in the dentistry domain. Upon integrating patients’ EMR, dental informatics offers a wide range of applications and tools for clinical practice, such as for the diagnosis of oral diseases, the prescription of medications, and the indications and contraindications in patients with certain conditions [10]. The introduction of a computerized health information system (HIS) has been the subject of investigation by many scholars. Gathering, storing, processing, and communicating vital information are the primary functions of HIS, which are used to coordinate and execute the delivery of medical care. Electronic dental records (EDRs) are a crucial component of the HIS. These records are used by medical professionals to track the medical and dental histories of the patients, as well as specific information on their diagnoses, medications, and consultations [24, 25].

With better dental health and patient outcomes as the ultimate goals, dental informatics enhances the detection and treatment of illnesses while hindering accidents. The efficiency of dental care delivery and its cost-benefit ratios are another focus area. Professionals can maintain their expertise and stay current on advances thanks to computers. In the absence of specific professional associations and core publications for dental informatics, a core group of academics is actively working in this area and publishing their rich outcomes. The difficulty with dental informatics education is that it is a subfield of medical informatics and not a distinct topic on its own [23, 24].

While some have suggested that dental informatics is a subfield of healthcare informatics, Allabun (2022) [23] highlighted several important distinctions between the two. The four main aspects that distinguish dentistry from healthcare are given as follows: First, there are a number of approaches to securing payment, such as the various billing requirements in both the medical and dental fields (thus, paperwork). Second, there are variations in the typical order of events for carrying out an examination, discussing findings with patients, and documenting the results. In the medical field, for instance, the location of the pain comes first, followed by the feeling of it, whereas in dentistry, the tooth number comes first, followed by the diagnosis. Third, there are distinctions in how treatment plans are created. A dental treatment plan is developed during the initial assessment and becomes the foundation for extensive, long-term planning consisting of a series of interconnected phases. As for the medical domain, the treatment plan is the patient's course of action (a road map). The final distinction lies in how an issue is related to the methodological explanation. If a doctor charts what a dentist does, it becomes insufficient because the term "treatment" signifies something is wrong with the patient's health.

As dentists gather, present, and analyze data differently from doctors in the medical line, along with some unparalleled aspects between the dental and medical domains, Allabun (2022) and Benoit et al. (2022) [23, 24] asserted that design work that informs medical records is irrelevant in dental records.

While the concept of medical informatics is more detailed when compared to the terminology of dental informatics, it is offered here to increase one’s comprehension of the informatics discipline. One may contend that this more comprehensive definition ought to be acceptable and that dental informatics should benefit from the work derived from healthcare informatics. Thus, one must not assume that the two fields are similar. The practice domains differ, and both disciplines have varying requirements.

The dentistry profession does not often receive ready-made solutions from other informatics fields, such as the advancement of electronic patient records in medicine, which has "translated into little or no development for dental practice" [26]. While general breakthroughs in informatics (e.g., image-processing methods and biological informatics) may apply to dental informatics, there are cases in which only field-specific solutions have relevance [26]. Although the discipline of dental informatics may benefit from studies in other domains, the solutions cannot be automatically expected to work in dental informatics. This indicates that there are some basic similarities and distinctions between dental and healthcare informatics. Besides, it is critical to comprehend when the two areas might complement one another and when it is imperative to keep them apart [9].

With some innovations (e.g., record systems and intra-oral cameras), the pervasiveness of computers has left its imprint on the dental domain. The use of IT in the dental segment aids dentists in making better choices for their patients. Although the commercial market has introduced some innovations to the dental industry, Taylor et al. (2021) [26] claimed that these innovations do not address all issues, such as the lack of open standards for sharing patient data among practitioners and the limited mechanisms to represent dental knowledge. Despite having some concerns addressed, the main setback here is the barrier to advancement. Computer science, information science, and cognitive science are integrated into dental informatics (see Figure 1) [27]. Information science is transformed into informatics when used in the medical and dental segments. Li et al. (2022) [9] stated that the main emphasis of informatics is on the study, progress, and assessment of information applications and models.

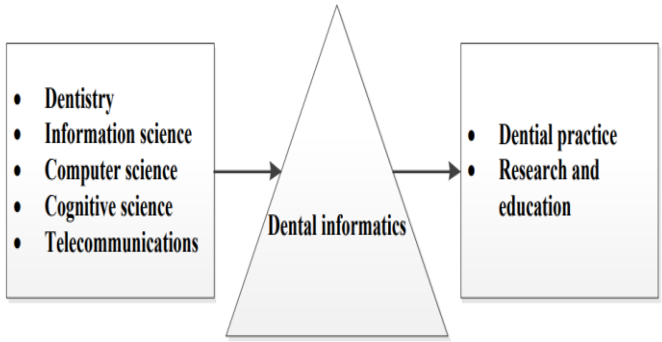

Fig 1: The integrated fields of sciences used to develop dental informatics and its applications [28].

5. Application of Dental Informatics in Dental Practice

A standardized terminology for dental diagnosis and treatment outcomes was absent at the beginning of the 21st century. Progress in the dental sector was inhibited as there was no coordinated approach among governments, medical facilities, and software designers. The International Classification of Diseases (ICD-9), the most widely used coding system at the time, provided little coding for dentistry, which was insufficient to arrive at an accurate dental diagnosis [29]. Hence, some scholars proposed several coding systems to overcome the issue, including EZCode, Systematized Nomenclature of Dentistry

(SNODENT), Ontology for Dental Research, and Oral Health and Disease Ontology [24]. Data accessible on coding systems in the dentistry domain was perplexing initially. To fit the purposes of dentistry, some of the prescribed classes experienced definitional changes, renaming initiatives, and coding system mergers.

To be used as a dental and oral health vocabulary in the electronic environment and to complement the Current Dental Terminology, the American Dental Association (ADA) proposed the SNODENT as a subset of the SNOMED-CT developed in 2007 (CDT). Diagnoses, signs, symptoms, and complaints that made up about 8,000 ideas led to the initiation of SNODENT. It provides standardized ideas to characterize oral health outcomes with clinical clarity so that dental practitioners can document patient treatment in the EHR for rigorous analysis. However, SNODENT has not been fully assimilated into the culture of dental providers, in contrast to SNOMED-CT and ICD. This is because diagnoses are not needed for billing (as in medicine) or post-coordination, do not offer sufficient coverage, and may pose implementation difficulties due to the large number of ideas. Besides, SNODENT is inapplicable in dentistry colleges. Before SNODENT can be merged into SNOMED-CT, substantial modifications must be made to the "content, quality of coding, and quality of ontological structure."

The dentistry software is designed to satisfy the requirements of contemporary dental practices. The system adheres to all standard operating procedures and establishes the processes necessary to execute the task effectively. The dental module includes all pertinent medical information needed to provide appropriate therapy in the field of dentistry. All information is displayed on a single screen. Theoretically, it can store and display X-rays, digital images, video clips, intra-oral camera documentation, and other forms of specialist technology [25].

6. Integration of Dental Informatics and Electronic Medical Records in Hospitals

The phrase "medical informatics" was initially used in France, but it did not make its way into English writing until the beginning of the 1970s [10]. There is a significant amount of value in amalgamating dental informatics and digital dentistry technology with the EMR system. Even though this combined system offers secure and effective archiving of digital documents, it is difficult to ensure secure and effective data storage [30].

The EDR, a vital component of HIS, enables medical professionals to store patients' medical and dental histories, as well as specific information on their diagnoses, medications, and consultations. The EDR controls data capture, has access to data storage, supports administrative procedures, and paves the path for public health policies due to its flawless integration with other HIS components [24].

The HIS is an all-encompassing solution that organizes individuals, processes, functions, and information. It is closely linked with population health statistics to perform planning and management effectively within the healthcare domain. The workforce, databases, technological infrastructure, and software make up the fundamental components of all information systems, including HIS. The integration of several healthcare systems and databases to create a single platform is the main objective of HIS, so that the system can perform its functions effectively. In the field of medical diagnostics, computers and information systems are applied to process and analyze information, such as CDSS, medical equipment, and software [25]. Imminently, computers have a crucial role in the diagnosis, treatment, and management of patients and healthcare settings (e.g., rehabilitation and therapy, laboratory testing, radiography, EMR, cancer treatment, medication and drug interaction, etc.). The shift from a paper-based environment to a paperless one within the healthcare setting has been acknowledged universally to increase both productivity and efficiency.

7. Conceptual Framework for Digital Dental Technologies AND Dental Informatics

A report published by World Economics in 2013 showed that a 10% increase in digitalization in any field or country would result in a 0.75% increase in Gross Domestic Product (GDP) per capita. The McKinsey Report in 2013 asserted that the average contribution of digitalization to GDP was 3.4%. The dental industry is a lucrative global market that reaps millions of dollars in revenue. Dental clinics are increasing annually due to higher awareness and growing demand. The demographic cohort of 18–40-year-olds is facing challenges related to oral healthcare, thus the growing interest in the dentistry field.

Van Der Zande et al. (2015) [31] delineated the diverse range of technological aids applied in the field of prosthodontics. These aids accounted for 93.2% of patient information and history and 82.4% of financial administration. Dental professionals have been implementing these technologies since 2005. Van Der Zande et al. (2015) [31] found that dentists incorporated various clinical and diagnostic technologies for oral radiographic procedures, in which Digital Orthopantomograms (OPG) constituted the majority at 57.2%, followed by intra-oral cameras at 26.4%, scanners at 12.0%, as well as digital 3D imaging and CERAC at 8.4%. The CEREC method includes both subtractive and additive manufacturing methods. The dental CEREC system has two phases: CAD and CAM. The CAD phase involves the use of digital impressions and restoration design, while the CAM phase prepares for restoration. The fabrication process is performed *in situ* in a dental laboratory or at a manufacturing facility. The CEREC system for dental restoration fabrication offers many advantages, including a lower number of intermediate stages than conventional production methods, standardization and automation of the manufacturing process, industrial prefabrication and control of materials, as well as simplified data storage. These factors substantially enhance the caliber and replicability of the restoration process.

Dental informatics involves computer and information science to improve many aspects of dental practice, research, and program administration. This field has progressed since the 1960s, during which the initial applications of informatics methodologies to address dental concerns were recorded [28]. The use of computers in dental offices in the US increased from 11% in 1984 to over 85% in 2009 [32]. Its main objective is to improve patient outcomes. To support and improve disease detection, treatment, and prevention, besides ensuring pain relief and oral health preservation, the discipline of dental informatics must be devoted to these goals. Some of the sub-objectives include the effective provision of dental care and steadfast support for related education and research endeavors.

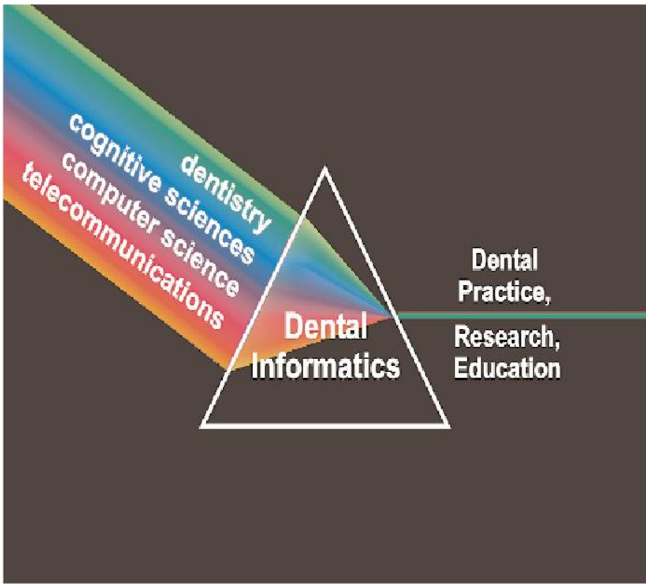

Fig 2: Four methodological underpinnings of dental informatics are combined to address issues in practice, research, and education [33].

Figure 2 portrays the integration of dental informatics with four significant components of informatics. This amalgamation serves as a means to arrive at effective solutions in the domains of dental practice, research, and education. The field of dental informatics draws upon a range of scientific disciplines, such as dentistry, computer science, cognitive science, and telecommunications, to develop methodologies and theories. The WHO stipulated that the field of dentistry has both scientific and artistic practices to prevent, diagnose, and treat conditions that affect teeth, jaws, and oral cavities.

The field of computer science is concerned with the comprehension and creation of computational systems as well as processes. It enhances and elaborates data representations, algorithms, programming languages, operating systems, and computational approaches, such as symbolic reasoning. The locus of this context lies in the manner in which data are illustrated, computed, adjusted, and administered in computational frameworks. A substantial increase has been observed in the use of clinical computing and EDR among dentists in the US over the past decade. A survey carried out by the ADA between 2006 and 2007 reported that the use of chairside computers among dentists escalated to 55.5%, while 9.2% of dental clinics adopted paperless systems [32]. Next, a survey performed in 2010 among dentists in California revealed that 23% of them had successfully integrated the EDR system into their practice [32]. In a recent survey, the Dental Practice-Based Research Network found that 14.3% of solo practitioners and 15.9% of group practitioners used the EDR. The EDR refers to a vital element in dental informatics that is designed to facilitate quality enhancement, evidence-based practices in patient care, decision-making, and the creation of novel insights. In order to achieve these objectives, it is crucial to transcend the present primary function of the Electronic Document Management System as a mere record-keeping tool that offers only a slight enhancement over conventional paper-based techniques. Figure 3 portrays the Conceptual framework that covered most of the digital dental technologies and dental informatics in dental practice.

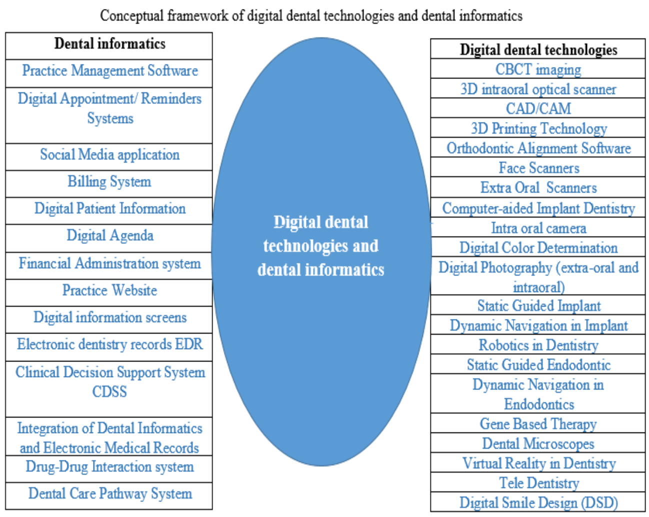

Fig 3: Conceptual framework for digital dental technologies and dental informatics

8. Discussion

Embedding digital technology in dental education offers several benefits. Virtual anatomy, realistic feedback tools, and enhanced digital simulation provide a range of options for preclinical education to be executed effectively because new technology enhances the students' learning experience. The use of digital evaluation tools in restorative dentistry and prosthodontics equips dental students with the ability to self-assess their performance in real-time and be independent of direct supervision. Many technologies applicable in the clinical context are part of the digital communication industry. These tools enable remote supervision and increase local administration of supervision. Besides, data generated by digital technology can significantly influence how dentistry is practiced. Big data and information sets pave the path for doctors and enable the process of machine learning and AI to facilitate dentists in making decisions during clinical practice [30].

There is an increment in the flow of digital work in dentistry due to technological progress, such as the emergence of intra-oral scanners and software programs. Besides enhancing communication between dentists and dental technicians, these new technologies have increased the amount of digital work. The growth of technology in dentistry has made it feasible to construct a comprehensive digital case and successfully tackle issues such as loss of vertical dimension [34].

The effective application of more recent technologies offers a higher standard of care while simultaneously increasing both efficiency and output. Patients will benefit from these productive advancements, but it may be a struggle for some dental professionals to incorporate these advancements into regular dental practice. The value of technological advancement is not always proportional to the practical realm in which the technology is supposed to simply speed up or add efficiency. For example, a patient is subjected to a significantly lower amount of radiation with digital radiography. Dismissing the need to schedule another appointment to collect results is the benefit that stands out to patients the most. Quick access, instant reports on the diagnosis, improved clinical treatment, and additional time for the dental staff to perform other tasks are some benefits of using the technology [10, 35].

Dental imaging has experienced significant technical advancements over the past several years. Apart from the digitized X-ray-based diagnostic procedures, technical advancements have enabled low-dose 3D CT and numerous innovative optical imaging techniques. Dental professionals can plan and simulate on-screen treatments when data from digital images is amalgamated and processed. They may also use 3D-printed models, precisely devise a virtual plan, and adhere to therapies [36].

The use of EDR data offers significant opportunities for the study because it is cost-efficient and improves efficiency. Sharing EDR data warehouses can help organize massive overriding records and data repositories connected to clinical research work. As data sources from the real world, EDRs may be used in studies to provide evidence from the actual world. The outcomes can hasten advances in treatment and improve outcomes for patients, besides providing significant insights for daily practice. Retrospective EDR-based studies, similar to other forms of retrospective studies, dismiss recruiting new patients or collecting new data as both time-consuming and costly. Although the reuse of EDR data can lower the cost of a study, facilitating a patient-centric study and accelerating the rate at which new medical breakthroughs are made could be restricted due to low data quality.

Since there is a responsibility for the variations in priorities between clinical practice and research, clinical data are not collected with the same level of care as research data. In addition to the correct work environment and workflow integration, the data should intercept basic errors and provide real-time feedback to keep the user informed about the current updates. This ensures the collection of more accurate and comprehensive information. Data retrieved from EDR can be used in the clinical decision support system (CDSS), which can later deliver clinical suggestions in real-time. They may be put to use in educational settings as well to train students on system applications [24].

The integration of dental software with other software packages generates excellent information exchange that enables dentists and physicians to access all medical information on their patients from a centralized database with just a few clicks of the mouse. The standardization of technology makes it possible to access and share patients' medical records and dental histories at the global level. The use of IT solutions results in high-quality medical services and care. One additional advantage of using this technology is the expedited procedure for identifying patients [25].

9. Conclusion

Several technologies in the dental industry have been adopted in dental practices, as mentioned above. There are several benefits to using dental digital technology in dental services, including how it will aid in prevention, treatment planning, analysis, diagnosis, treatment, maintenance, research, and education, as well as virtual treatments that allow patients and dental professionals to see the outcome before beginning actual treatment. Also, increase patient satisfaction, results, safety, productivity, duration of treatment, and so on. The implementation of digital technology in dental practice carries several benefits.

Informatics and digital technologies in each sub-specialty of dentistry give various options and are strong enablers to carry out dentistry in a more effective and safe manner in general.

10. Acknowledgment:

The authors acknowledge the full support received from Universiti Sains Malaysia, Penang, Malaysia, and are especially thankful to the School of Computer Sciences for their encouragement and support.

Conflicts of interest

The authors declare no conflicts of interest.

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