

Applications of Information Technology in Dentistry

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Abstract

There has been tremendous impact of information technology (IT) on how we carry out our professional and personal work efficiently and effectively. “Information technology (IT) is defined as capabilities offered to organizations by computers, software applications, and telecommunications to deliver data, information, and knowledge to individuals and processes.” As compared to traditional methods, IT enabled solutions are promising in many ways for clinical care, education and research. Use of IT in dentistry is increasing day by day in form of clinical care, dental education, patient education, research, administration, electronic dental records, teledentistry, design and production, digital radiography and digital photography. This review discusses all these potential applications of IT in dentistry.

Keywords: Information technology, Dentistry, Dental informatics, Health information technology

Introduction

Information Technology (IT) is considered as future in almost all segments of life including medical sciences. “Information technology (IT) is defined as capabilities offered to organizations by computers, software applications, and telecommunications to deliver data, information, and knowledge to individuals and processes.”¹ Over a period of time, IT has changes the ways we study and practice many disciplines and dentistry is no exception to this. If we look at the advancement of IT, in last fifty years the growth is enormous². Vocal, pictorial, textual or numerical type of data can be generated, processed, stored, retrieved, transformed, and

disseminated with help of electronic systems of IT. Use of IT in dentistry is increasing day by day in form of clinical care, dental education, patient education, research, administration, electronic dental records, teledentistry, design and production, digital radiography and digital photography. Advancement in IT has empowered healthcare professional to receive and transmit data anytime and anywhere in the world³. This review discusses potential application of IT in the field of dentistry.

Information technology and dentistry

Computers were introduced in the market in mid 1940s and since then it unequivocal success has follow it⁴. Over period time computers have become more and more affordable and accessible for general public. Use of computers has increased with the invention of internet in early 1960s by military of USA to develop workable communication system⁵. Combined use of computer and internet has made it possible to share the database which has become an important part of information technology. IT has drastically changed the ways we carry out our professional and personal work effectively and efficiently³. Following list mentions potential applications of IT in dentistry.

1. Dental Education
2. Patient Education
3. Clinical Care
4. Research
5. Administration
6. Electronic Dental Records (EDRs)
7. Digital Radiography
8. Digital Photography
9. Teledentistry
10. Design and Production

Dental Education

Like clinical domain, academic domain has been positively affected by emerging technology in dentistry⁶. Many android and iOS apps are available which makes dental learning quite easy for students and faculty as well. Due to availability of information at one's fingertips via e-textbooks and journals, evidence based dentistry is being practiced like never before. Simulations have provided more realistic perception of both clinical and preclinical areas for better understanding of the subject². IT has made possible to conduct continuing dental education programs through e-learning, distance learning, broadcasting teaching and webinars and thus IT has helped to cross boundaries of traditional teaching methods.

Patient Education

Nowadays, Patient's appetite for information has enhanced beyond just asking advice from doctor as they have become more and more tech-savvy. On daily basis, many patients interact with variety of search engines, glossaries and online journals, patient support groups on social media apps and even chat bots are available to answer questions related to their health before they visit doctor. Computerized patient information systems have evolved which replace traditional form of patient education brochures, videotapes, leaflets which are quite promising⁷. Portable video technology has enabled patients to seek education session via internet through personal computer or handheld device⁸. IT can help in chair side diagnostic education, display of virtual treatment plans, patient motivation and consent process in efficient and effective manner⁹. Although these solutions are didactic in nature they are intended to improve patient-doctor interaction but not to replace them.¹⁰

Clinical care

Interactions and associations between general health and oral health are now well established which are complex, bidirectional and involves many pathways¹¹. Many such associations are found between oral health and systemic health like diabetes, pulmonary disease, atherosclerotic disease, kidney disease, birth weight, pregnancy and osteoporosis¹². It is customary to ask about medical history of a dental patient while treating to avoid potential complication due to underlying systemic condition. IT enabled EHR systems can help to develop meaningful treatment plan by collaborating with different health care providers².

Research

Nowadays, research has become more complex so there is increased need of IT support. Most commonly used tool for entering, managing and analyzing data is Microsoft Excel. Potential of IT in dental research is not much utilized as compared to clinical care and education. Clinical care data can be reused which can reduce the need for expensive primary research. Dental informatics is emerging branch in dentistry.

Administration

In an educational setting, student's clinical performance can be evaluated with help of clinical management system by incorporating performance criteria so that the rater can understand student's performance and students can do self-evaluation. In a clinical setting, many administrative tasks can be managed effectively such as scheduling activities/work, human resource management, communication with other departments and laboratories, marketing of hospitals, financial and accounting procedures, supply chain management, purchasing and inventory control.¹³

Electronic Dental Records (EDRs)

Dentists can use electronic dental record system as a practice management system which can help dentists to capture clinical care data and demographics in more efficient manner. A thin intraoral camera can be used to capture images of patient's intraoral finding so that later diagnosis and treatment planning can be done by dentists.¹⁴ Other than imaging, IT can be used for appointment and scheduling of patient, medical alerts, e-prescription, insurance claim processing, interdisciplinary collaboration and expert opinion.⁹

Digital radiography

It is also known as direct digital radiography which directly captures digital data by using x-ray sensitive plates and transfer it to computer system.¹⁵ Advancement in technology has enabled oral radiologist and dentist to use CAD (Computer Aided Diagnosis) to make accurate and more efficient diagnosis of dental diseases by using computerized analysis.¹⁶ Other benefits of computerized systems are easy image processing and enhancement, easy image retrieval and sharing, and reduced radiation exposure.

Digital Photography

There are many reasons for using digital photography in dentistry which includes dental record keeping, diagnosis and treatment planning, patient education and communication, specialist consultation, insurance verification, professional advertising and marketing, self education and treatment philosophy.¹⁷ Thus clinical photography has become an essential tool in routine dental practice.

Teledentistry

Use of computers and internet has enabled healthcare sector to use teledentistry. It is combination of telecommunication system and dentistry which involves exchange clinical information and images over remote

distance for consultation and formulating treatment planning. It has potential to extend delivery of oral health care to underserved population in residing in remote areas.

Design and production

New age of technology started with the introduction of CAD/CAM i.e. Computer-Aided Designing / Computer-Aided Manufacturing in late 20th century.¹⁸ Combined use of cone beam computed tomography, intraoral scanning and CAD/CAM technology enabled 3D printing helps in production of drill guides for dental implants, craniomaxillofacial and orthopedic implants, the production of physical models for prosthodontics, orthodontics and surgery, and the fabrication of copings and frameworks for implant and dental restorations. Chair side 3D Scanning is being used in a clinic which sends clinical data to dental laboratory where prosthesis is made exclusively by CAM using modern dental materials which also reduces chair side time in subsequent visits.¹⁹

Conclusion

There have been positive impacts of information technology in dentistry in many ways which has made routine dental practice much easier than before. It has potential to improve overall efficiency, efficacy, quality care, and organization in dentistry. As compared to traditional methods, IT enabled solutions are promising in many ways for clinical care, education and research.

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