

Systematic Review of the Online Data Available for Educational Applications in Prosthodontics

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Abstract

Background: Prosthodontics is the branch of dentistry that deals with the replacement of missing teeth and other orofacial structures with artificial substitute. In prosthodontics, implants, removable and fixed dentures can be used to replace missing teeth. Digital dentistry is the new trend that is evolving globally among the dental professionals and the dental students. Interactive learning concepts and objective evaluation in this digital Technologies with 24/7 access to the dental undergraduates and post graduates in providing education and training about prosthodontics is highly valuable.

Aim: The aim of this study is to do the systematic review of the online Data available for educational applications for Prosthodontics. **Materials and Methods:** In order to conduct a systematic review of the online data available for educational applications in prosthodontics, the rules and guidelines of preferred reporting items of systematic reviews and meta-analysis (PRISMA) were followed. **Results:** Of the total 453 articles only about 11 articles were included in the systematic review that reported the online data available for educational applications in prosthodontics. **Conclusion:** The dental education of prosthodontics can be revolutionized, using the online available data to create educational applications.

Keywords: Prosthodontics, prosthodontist, digitalization, education applications, online data, virtual learning, digital dentistry.

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INTRODUCTION

In Present time, information and Communication Technology is a crucial element of learning and teaching in case of Healthcare professionals. The aspect of clinical practice by the Healthcare professionals has been transformed by implementing educational applications of mobile devices. For Communication, information management and clinical decision various applications have been created in the mobile devices that are made common for Healthcare settings. In order to manage patient's record, clinical trial discussion, preparation of post graduate examination various kinds of apps are available in the field of dentistry. The dental graduates and dental professionals of the present generation are positive about using numerous mobile apps for practice.

The branch of dentistry that deals with the replacement of missing teeth and other orofacial structures with artificial substitute is called as prosthodontics. Implants, removable and fixed dentures

can be used to replace missing teeth in the patient. This artificial substitutes are mostly made up of metals, ceramics, heat cure acrylic and cold cure acrylic. Digital dentistry is the new trend that is evolving globally among the dental professionals and the dental students [1].

Many of the Western countries have been using well-equipped Software Solutions to manage patient's record, to make an appointment, recall reminders, ordering materials, managing the maintenance contract of the medical devices, checking the working time schedule. Digital dentistry can assist to provide knowledge and information about maintaining the medical history of the patient and also perform digital radiography, take intra-oral photographs and also provides the medicine list. The restorations can be fabricated in the laboratory in order to plan the oral rehabilitation by using the intra-oral optical scanning (IOS) [2]. The three-dimensional radiography for guided implant placement can be done using the the digital dentistry.

In most of the dental laboratories the IOS scanner is used especially in the European countries. The 3D model files that are given by the clinician using the IOS is used by the dental technician to facilitate the fabrication of restorations. The digital design created has various advantages in case of quality control, information about the material thickness And also the cross section values of connector when compared to waxing. The Prosthodontic product that are manufactured in the industries using additive printing process with subtractive meaning can be improvised. The dental wax castings have shortcomings leading to various errors and shrinkage cavities [3].

In order to enhance the clinical correlation, Spatial ability, Critical thinking, Interactivity of the students a number of 3D educational programs have been launched. This 3D education programs are integrated with multiple dental disciplines. 3D visualisation gives Augmented reality (AR) to the tooth morphology that helps in the treatment of removable or fixed partial dentures. Due to the identical set-ups the transparency for all the students is to be enhanced using digital Technologies that include 3D printing of virtual teeth.

Educational motor skills, training and clinical testing is increased using the application of virtual reality (VR) and the Augmented reality (AR) using the maxillofacial surgical protocols. Interactive learning concepts and objective evaluation in this digital Technologies with 24/7 access to the dental undergraduates and post graduates in providing education and training about prosthodontics is highly valuable. In recent times the simulation of hardware, realism of simulation, scoring system and validation is to be done using the virtual reality applications especially in case of preclinical Prosthodontic education. There is a high need for the use of virtual reality application in the Prosthodontic education. In order to understand the benefits and limitations of the conventional and digital processes a proper training need to be provided to the dental professionals, medical doctors, insurance providers, dental students and Dental technicians [4]. This digital training helps the Prosthodontic students manage to digitalise data and also ensure the safety of the patient.

Various Advanced Dental education programs in the Prosthodontic specialisation is to be provided in order to educate the graduate dental students to give better delivery of prosthodontic care. The dental student should be trained to perform the wide range of clinical procedures in the speciality of prosthodontics at the level of proficiency. Prosthodontic faculty need to recognise and select experienced and highly competent prosthodontics that helps to accomplish the management of patients, prosthetic needs successfully by giving comfortable, satisfied, acceptable and efficient prosthodontic treatment on time. Dental

education programs in prosthodontics can help and educate the graduate dental students to perform research in prosthodontics efficiently. The prosthodontic dental teaching can encourage the dental students virtually grow using the digital platform. The digital training skills includes the IOS with digital surface mapping, 3D printing and prototyping. In order to improve their education and training of the dental graduates in prosthodontics, digital applications can be used [5].

The Saudi Commission for health specialities (SCFHS) updates the information related to prosthodontics available online. It provides curriculum development in the field of Medical and Dental education related to the literature on prosthodontics and is made available online for the dental students of Saudi Arabia. The literature that is related to the prosthodontic residents, observation of test performed by the prosthodontics, critical incidents related to prosthodontics and study of role model (prosthodontist). To create educational application for prosthodontics, the information related to diagnosis, treatment, rehabilitation and maintenance of the oral cavity should be available. There is a lack of evidence of systematic review of the online data that is made available for the educational applications in prosthodontics and hence this topic was selected.

AIM AND OBJECTIVES

The aim of this study is to do the systematic review of the online Data available for educational applications for Prosthodontics.

FILTERS USED

Human studies, studies in English language, adults of 18 years and old.

TIME LINE OF STUDY

A total of 6 months time was taken collect the data, analyze it, write the manuscript and proposal, and review the manuscript and proposal.

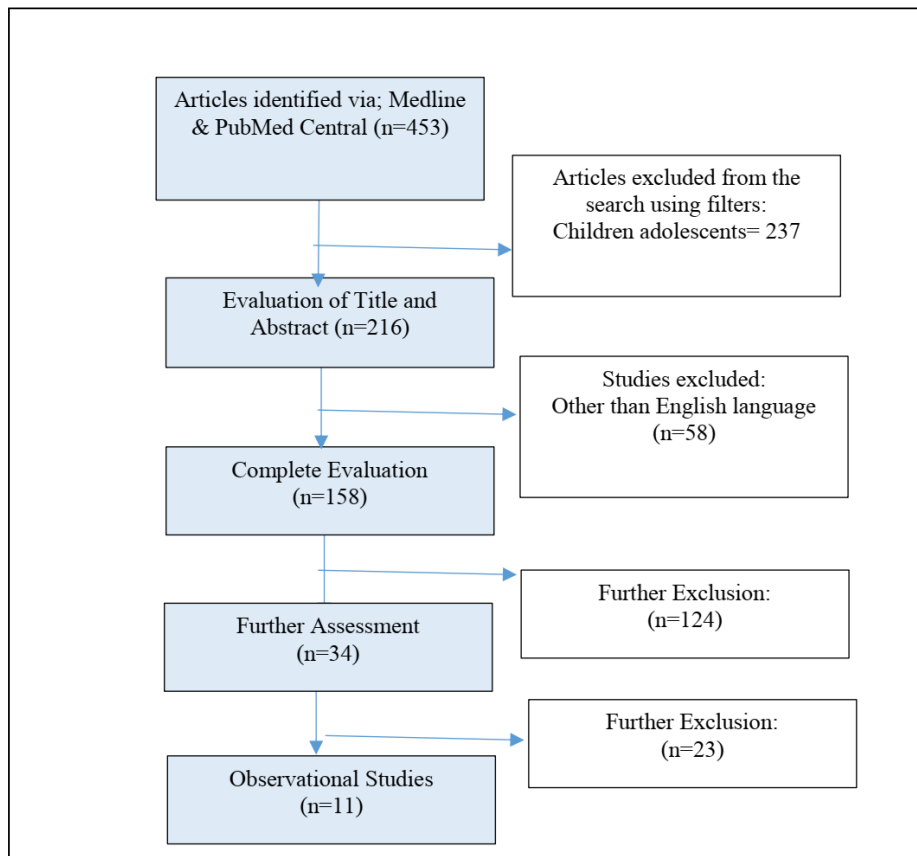
METHODOLOGY

The rules and guidelines of preferred reporting items of systematic reviews and meta-analysis (PRISMA) were followed in order to conduct a systematic review of the present topic. The systematic review was carried out in English language. The systematic review was done by an electronic search using PUBMED, Medline, Scopus, and Embase. All the articles that follow the inclusion criteria were selected for the systematic review of literature related to the online data available for educational applications in prosthodontics. After the selection of the articles they were searched manually by the principal investigator. All the information extracted from the online web search was entered in a pre designed Data extraction form. The outcome of the research is clearly observed and the results are recorded. The descriptive studies,

case-control studies, cohort studies, randomised controlled trials and observational trials were investigated to systematically review the literature that is made available for the educational application. The articles that were incomplete and not didn't provide complete information about the study design are excluded from this research. The reviewers of this research individually studied and reviewed the title, abstract and full text related to each article based on the inclusion criteria. Mutual conflicts or disagreement regarding the research was resolved by carrying out a discussion.

RESULTS

Identified about 453 titles that were related to the educational data on prosthodontics. After screening 216 articles were selected. The articles in only English language was selected. About 158 articles were selected after eliminating the studies with only abstracts. Using the filters about 34 articles were selected for reviewing by the principal investigator. Upon manual reviewing by the reviewers only about 11 articles were included in the systematic review that reported the online data available for educational applications in prosthodontics.



Natural ageing, innate disease, or accident causes the loss of natural teeth and oral structures which can be a traumatizing incident in a patient's life. Due to the loss of natural teeth a person can lose his ability to chew his food and smile. This can lead to Embarrassment and the person avoid public gatherings. In order to enhance the quality of life of such person, prosthodontics plays an important role in restoring the the missing teeth and other oral structures.

The branch of dentistry that focuses on designing, developing and fitting of artificial restoration for the missing teeth is called as prosthodontics. By following proper diagnosis, treatment plan, rehabilitation and maintenance Dentists can restore oral function and facial appearance of the patient. The dentist that is specialised to restore the teeth by using

artificial restoration it's called as a prosthodontist. After completion of graduation from a dental School the dentist need to take advanced training in prosthodontics to become a prosthodontist. The prosthodontist need to be efficiently trained in various aspects like dental implants, crown, temporomandibular disorder, bridges and aesthetics. Sometimes Prosthodontist are referred to as 'Architects of the smile'.

Prosthetic restorations need to be carried out for the following reasons: Replacing missing teeth, dental implantation, cosmetic dentistry, removable or fixed partial dentures, snoring disorders, traumatic injuries of oral cavity and Jaws, geriatric patients, temporomandibular joint disorder, babies born with cleft palates, and oral cancer reconstruction.

AUTHOR'S NAME	YEAR OF STUDY	STUDY CONDUCTED ON	SOURCE	DISCUSSION	RESULTS
G N Graser et al., [6]	1990	Removable prosthodontic education	J Prosthet Dent	The practitioner's interest in removable prosthodontics as it relates to new techniques and materials remains high according to a 1988 survey of Academy of General Dentistry members.	Removable prosthodontics was rated first in regards to continuing education courses desired by its members.
G P Mc Givney et al., [7]	1990	Advanced education in prosthodontics	J Prosthet Dent	Accredited advanced education programs in prosthodontics are currently meeting the standard guidelines for clinical and didactic experiences	TMJ therapy and geriatric dentistry need to be better defined in the educational guidelines.
Douglas V Chaytor et al., [8]	2005	Changes in prosthodontics education, past and future	J Can Dent Assoc	Organizational support for defining the speciality of prosthodontics to encompass a broad spectrum of dental restorations and related care helped develop commitment to improved research and education.	Prosthodontic education will continue to evolve, but it will be influenced by its institutional and professional environments.
Gunnar E Carlsson et al., [9]	2006	Trends in prosthodontics	Med Princ Pract	Another factor increasingly influencing prosthodontic practice is patients' awareness of newer technologies in aesthetic dentistry.	It describes the recent developments in prosthodontics and its therapeutic areas, and the impact such developments may have on the theory and practice of the discipline.
Saeed Dshpande et al., [10]	2017	Mobile learning app	Educ Health (Abingdon)	A greater confidence in their clinical decision making around prostheses through this app and 94% of the students felt that this app should be regularly used along with conventional teaching techniques.	Clinical decision-making in prosthodontics, a mobile learning app, is an effective way to improve clinical reasoning skills for planning prosthodontic rehabilitation.
Stephen D Campbell et al., [11]	2017	Removable partial denture	J Prosthet Dent	The data on treatment for partial edentulism were reviewed and summarized with a focus on currently available and future RPD designs, materials, means of production, and impact on oral health.	Advances in materials and digital design/production along with patient education promise to further the application of RPDs and improve the quality of life for patients requiring RPDs.

Trevor D Crafts et al., [12]	2017	Three Dimensional Printing	Otolaryngol Head Neck Surg	Emerging technologies include the printing of tissue scaffolds for the auricle and nose, more realistic training models, and personalized implantable medical devices.	Educational and training models provide an opportunity to better visualize anomalies, practice surgical technique, predict problems that might arise, and improve quality by reducing mistakes.
D Kalpana et al., [13]	2018	Digital Dental Photography	Indian J Dent Res	Application in dental practice is simple, fast, and extremely useful in documenting procedures of work, education of patients, and pursuing clinical investigations, thus providing many benefits to the dentists and patients.	Digital dental photography over film photography, basic armamentarium for obtaining good photographs, and how digital dental photography is beneficial in the field of prosthodontics.
Charles J Goodacre et al., [14]	2018	Digital learning resources in prosthodontics	J Prosthodont	These key factors can be incorporated into student learning through the use of 3D education programs in class. Lessons learned from using these programs include the importance of regular use in class as well as testing students both visually and textually	The students miss an opportunity to enhance their ability to visualize structures three dimensionally and manipulate them in their minds, a process known as spatial ability that is linked to success in the sciences.
E Alexakou et al., [15]	2019	Clinical applications in prosthodontics	Eur J Prosthodont Restor Dent	Polyether ether ketone (PEEK) is a polymer with many potential applications in dentistry.	The current trend is moving towards the use of metal-free restorations and biomaterials which exhibit advanced properties in the complex oral environment. The educational data related to this can enhance the Dental teaching.
Ahmed Mahrous et al., [16]	2019	Latest advancements in virtual 3D Modelling	J Prosthodont	the use of 3D modelling software has enabled the creation of 3D models that can be altered or customized to be used in a more flexible way to teach students in the arts and complexities of removable partial denture (RPD) design and associated components.	It demonstrates using videos and web-based portals to show how the 3D RPD models were created and then used for educational purposes.

Knowledge about simulator training in the preparation of cavity is to be made available for the undergraduate dental students especially in case of surgical interventions. Due to availability of virtual reality computer-assisted data, the instruction time of teaching from the faculty can be minimised. The data online for education applications in prosthodontics can

access improvised interaction in the virtual oral environment. The virtual oral environment can explore the mandible, maxilla, tongue, enamel, dentine, cementum and pulp of the oral cavity. Knowledge about Computer aided design (CAD) and Computer aided manufacturing (CAM) can help in enhancing the student's with crown digitalization and framework

design. The use of online data for the education applications in prosthodontics can help the inexperienced dental students to acquire skills needed for using digital tools. However the training given can be time-consuming when compared to the conventional techniques.

Detailed Knowledge about 3D Rapid prototyping can help in training the graduate dental students about the specialised techniques and skills. The graduate dental students prefer the digital Technologies in learning about prosthodontics when come to the conventional method of teaching. The use of textbooks for gaining knowledge and training in prosthodontics have decreased due to extensive use of educational applications.

Various studies reported that the student's Diagnostic skills are enhanced by using the digital educational applications in prosthodontics with the data that is available online. The Computer aided learning programs helps in increasing the accuracy of radiographic detection of caries. Many of the dental students have positive attitude and learning in prosthodontics for the development of educational applications using the data available online.

However with this study we do not intend to replace communicative interactions between prosthodontic faculty and dental students with the educational applications. This study Aims to just enhance the learning and training program in prosthodontics for better productivity using the digital applications.

DISCUSSION

The present study aimed to systematically review the literature that is available online in the field of prosthodontics. The online data can help in creating educational digital applications that can enhance the quality of education. A descriptive approach systematic review of prosthodontic literature was done. In the present time, especially in case of pandemic situations the digitalization in the dental education is required. The content related to prosthodontics that is made online need to be authentic. The educational applications also help in increasing the communication between the students and teachers, thus facilitating their learning ability via digitalization [16]. Training and instruction need to be provided for E-learning and E-teaching to both dental students and dental faculty respectively [17]. With the availability of the online data in prosthodontics a student can get easy assistance in all 24 hours of the day [18]. Due to covid-19 pandemic that was initially identified in the year 2019, many dental schools were closed as a precautionary step [19]. If the dental education is not digitalised using the web based learning platforms, no interactive learning can be made between the student and the dental faculty [20]. The educational applications in prosthodontics can

include the videos and other interactive tools to ease learning [21]. Information related to prosthodontics that is made available online need to be properly assessed by the dental faculty to avoid misleading [22]. The interactive digital educational applications can make the student learn to self access their work with self reflection and get proper guidance from the faculty [23-25].

Inspite of the Global digitalization of dental teaching, the data available related to the prosthodontics is not up to mark. Proper information about the diagnosis, treatment plan, rehabilitation and maintenance of prosthodontics is unavailable online. More research need to be carried out to determine the accuracy of the available prosthodontic data online. The protocols and guidelines need to be maintained by the educational applications to provide correct and authentic knowledge to the dental graduates about prosthodontics. Digitalization and transformation about the dental education is trending all across the world.

CONCLUSION

Simulation related to e-learning and e-teaching, need to be added in the dental curriculum, to enhance the use of digital tools and educational applications for dental education. The guidelines need to be established in case of digital standards of prosthodontics education. The dental education of prosthodontics can be revolutionized, using the online available data to create educational applications. The content from various text books of prosthodontics should be made available online for easy access to the student. The conventional system of learning followed the use of text book knowledge for the students that was not easy, but with digitalization the information is much easy to access.

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