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AN OVERVIEW ON DIGITAL PROSTHODONTICS, LITERATURE REVIEW

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Abstract

Background: New prospects in prosthodontics are guaranteed by the ongoing advancements in dental processing in a fully virtual setting devoid of any real-world model scenarios. For the treatment of toothborne or implant-supported fixed reconstructions, the comparison of fully digitalized workflows with conventional and/or mixed analog-digital workflows was the main objective. faculty members, time, and resources.,
Methods: The Medline, Pubmed, Embase, NCBI, and Cochrane databases were searched for studies on Digital prosthodontics, use, efficacy, prognosais.
Conclusion: While digital technologies have indeed become more prevalent in dental education, many institutions face barriers to implementation. More research must be conducted in order to support the continued incorporation of digital technologies into dental education.

Keywords: Fixed prosthodontics, Complete digital workflow, prosthodontics, dentistry, dental impression, impression accuracy, dental impression, digital dentistry, CAD/CAM

Introduction

Digital innovations have transformed dentistry in the previous ten years, including 3D printing, intraoral optical scanners (IOSs), computer-aided design and manufacture (CADCAM), and 3D radiography imaging with 3D analytic software. These devices have enhanced treatment outcome predictability and efficiency while revolutionizing the traditional clinical process. For

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instance, research has shown that totally digital workflows are possible in fixed prosthodontics (1). Additionally, all stages of dental implant therapy—including diagnosis, planning, guided surgical placement, and implant restoration—have been simplified by these technologies. Surgical simulation systems have benefits for teaching and training beyond their clinical applications (2). The earliest literary description of CAD-CAM technology in the creation of removable prosthesis dates back to 1994 (3). Since Goodacre unveiled the CAD-CAM complete denture system in 2012 (4), CAD-CAM technology has been applied in removable prosthodontics. In contrast to fixed prosthodontics, however, CAD-CAM technologies have not been applied as extensively in detachable prosthodontics. The intricacy of documenting maxillary-mandibular relationships and the challenges associated with digitally scanning soft tissue could be the cause of removable prosthodontics' limits. Even yet, in 2012 there were just two systems available. Historically, dental research has primarily concentrated on one of these three steps. Usually, the emphasis was on the accuracy and precision of in vitro studies, contrasting either various IOS systems or quick prototyping techniques for creating the final restorations. The dental literature was devoid of clinical investigations, especially randomized controlled trials (RCTs) that examined the complete digital workflow, with the exception of a few single case reports. It's critical to comprehend how the current digitalization movement is altering traditional protocols with regard to long-term outcomes, clinical and technological viability of fully digital processes, and financial ramifications (5). The first systematic evaluation to look for evidence of the application of full digital workflows in fixed prosthodontics for treatment with tooth-borne or implant-supported fixed restorations was conducted in 2017. The degree of evidence supporting comprehensive digital workflows was found to be poor in this study, as evidenced by the inclusion of only three papers examining single-unit restorations and the absence of any research at the time identifying multi-unit restorations (6). The use of digital technology and software in dentistry is rapidly advancing. Both for IOS systems and the CAD/CAM industry, a large number of new technologies and commercial solutions have been introduced in recent years. For the year 2022, a general PubMed search with the term "digital dentistry" returns 2070 publications. Just 953 of the techniques—or less than half—are found when the examination is restricted to the year 2017 (the time of the original review). It would be interesting to find out whether the percentage of qualitative clinical studies in fixed prosthodontics has increased in tandem with this trend, given the significant growth in such a short amount of time (6).

Digital Fixed Prosthodontics:

There will always be fresh potential in the field of fixed prosthodontics thanks to the ongoing advancements in computer technology and dental processing (7). Traditionally, the lost-wax process was utilized to manufacture acrylic and porcelain fused to metal reconstructions. Stone castings were also a part of the normal treatment strategy. On the other hand, computerized engineering technology is associated with reliable accuracy and repeatable output, which leads to a labor-saving, efficient work process (8). The development of CAD/CAM technology has revolutionized the production of monolithic fixed dental prostheses (FDP) that are supported by implants and are tooth-borne. This is achieved through the use of dental software applications for digital on-screen design and secondary computer-aided production for rapid prototyping processes like 3D printing and milling, all in a virtual environment devoid of actual model situations (9). The dental team consisting of a technician and a clinician must decide when and how to continue digitally vs sticking with traditional methods, as there are numerous organizations that offer computerized software applications and technical devices. There is neither a fully digital workflow

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nor a pure traditional pathway in dentistry company, as the facts demonstrate. One digital work step infiltrates the tried-and-true gold standard methodology (10). Prosthodontic therapy is changing rapidly. Intraoral scanning (IOS) and CAD/CAM creation of anatomically full-contour restorations or frameworks in conjunction with CAD-on veneering are gradually replacing impression-taking processes. A mixed analog-digital workflow that combines the best aspects of both approaches is the outcome of this evolution (11). Analyzing digital workflows in fixed prosthodontics has often been limited to a small number of technical publications. The research was restricted to clinical case series that focused on individual therapy phases, like IOS compared to traditional impression-taking processes, or in-vitro studies that examined laboratory precision (12). It is imperative to comprehend the implications of the digitalization trend on the modification of established conventional protocols in fixed prosthodontics by examining the scientific validation and evidence supporting the clinical and technical feasibility, the biological (long-term) outcomes, and the economic analyses of complete digital workflows (13). There isn't a systematic review that looks into prosthodontics' entire digital workflow available right now.

Digital Removable Prosthodontics:

In reference to the duration of CAD-CAM CD integration into the curriculum, most advanced graduate prosthodontic (AGP) and partial dentures in predoctoral (PP) programs responded with approximately five years, while none of them provided a response longer than ten years. It's interesting to note that 11.1% of PP and 12.5% of AGP reported having CAD-CAM CD in their clinical curriculum for roughly six to ten years. When compared to didactic and clinical practice, the AGP and PP programs, which used CAD-CAM CD for around five years, showed the lowest degree of implementation in preclinical laboratory activities (14). Preclinical laboratory exercises showed the highest level of adoption in programs that had adopted CAD-CAM CD less than a year prior. Preclinical instruction was given more weight in the PP programs that most recently incorporated CAD-CAM CD into their curricula (66.7%), suggesting that stronger preclinical education resources have recently become accessible. The majority of programs taught digital scanning/impressions, digital articulation, digital tooth setup, and CAD-CAM CD denture production when questioned about the substance of their CAD-CAM CD curriculum. Regarding impressions, the most popular technique was digital scanning of master models, which was used in clinical practice by about 80% of AGP. It's interesting to note that no PP program included instruction on intraoral digital scanning or digital scanning of impressions during preclinical activities. In didactic courses and clinical practice, over 50% of AGP and PP taught digital articulation, digital tooth setup, and denture production using CAD-CAM techniques. In their clinical practice, more than 80 percent of AGP and PP employed CAD-CAM denture manufacture procedures. In preclinical exercises, AGP has used less CAD-CAM articulation and teeth configuration than PP (14). CAD-CAM CD systems implemented in the AGP curricula included AvaDent® (87.5%), DENTCATM® (12.5%), and Wieland Digital Denture® (6.3%), and PP curricula utilized AvaDent® (66.7%) and Baltic Denture System® (8.3%). Regarding the percentage of cases that used CAD-CAM technology to fabricate complete dentures, 90% of PP and 80% of AGP answered <10%. 20% of AGP used CAD-CAM technology for 11∼50% of cases, indicating a higher implementation level in AGP as compared with PP. None of the programs utilized CAD-CAM technology for more than 50% of cases meaning that conventional techniques still remained the standard method. "What content of CAD-CAM RPD does your program teach?" she enquired. The majority were instructing students in digital fabrication and setup, digital articulation, digital scanning and impression, and digital framework design. In

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didactic, preclinical, and clinical practice, digital scanning of master models was the most favored approach for impressions for both AGP and PP. Digital framework design was incorporated into didactic, preclinical, and clinical curricula by the majority of AGP (92–100%). However, only 33% and 50% of PP used framework design and fabrication in their preclinical and clinical curricula, respectively, while 100% of PP used these strategies in their didactic curriculum. Dental System® (66.7%), Exocad® (28.6%), and DWOS CAD-CAM Software® (10.0%) were the CAD-CAM RPD systems that were implemented in the curriculum for AGP, and 50.5%, 26.3%, and 0% for PP, respectively. Additional systems that were utilized were Stoneglass®, Planscan®, MeshMixer®, coDiagnostics®, and NobelBiocare®. When asked what proportion of instances involved the use of CAD-CAM technology to create partial dentures, 50% of AGP and 37.5% of PP responded with less than 10%, and 33.3% of AGP and 37.5% of PP responded with more than 50%. Remarkably, 16.7% of AGP and 25% of PP responded with more than 76% (14).

Advantages of digital Prosthodontics:

Compared to traditional impressions, digital impressions have more accuracy and precision; they also eliminate messy impression materials, which reduces patient discomfort and gag reflex; they expedite restoration turnaround times by allowing digital impressions to be instantly transmitted to dental laboratories; they facilitate better communication between dentists and dental technicians by enabling remote file sharing and collaboration; and they improve patient education and treatment planning by enabling patients to view and manipulate digital models (15). All things considered, digital dentistry brings about a great deal of progress and advantages for the dental industry. It has completely changed the way dentists operate, enabling more effective and efficient treatments. Digital dentistry has greatly improved patient results and experience, from cost savings to better communication (16). Patients now have better oral health thanks to dentists' ability to perform precise and flawless dental procedures thanks to its connection with other digital technology. Without a question, digital dentistry is reshaping dental care in the future by increasing accessibility and convenience for all parties.

Conclusion:

In general, technology is changing quite quickly in this day and age, and dentistry is no exception. Every day, new digital technologies are created, and they are showing promise in producing more precise and effective therapeutic results. Dental education needs to be at the forefront of these innovations in order to produce doctors who are proficient in employing these technologies. We can forecast implementation trends and comprehend the obstacles preventing educational institutions from implementing these technologies by evaluating the existing status of CAD-CAM removable prosthodontics in dentistry curricula. Our latest research shows that while digital technologies are increasingly used in dental education, many still encounter implementation challenges. Programs are generally constrained by a lack of funding, materials, staff, and time.

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