Expanding the Application of Digital Dentistry with 3D Patient Monitoring

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Digital dentistry is an integral part of modern clinical practice, given its numerous perceived advantages and improvements in efficiency, technical precision, and routine predictability. Patients have also benefitted from improved time efficiencies and comfort. Moreover, novel and diverse dental technologies continue to improve aspects of diagnosis and communication. The first thing that probably comes to mind when digital dentistry is discussed is CAD/CAM–produced restorations, given the technology’s impact via intraoral scanners, CAD software, and milling/printing units, which are already an important part of routine clinical workflow in a global context. However, contemporary digital dentistry now surpasses this initial concept, since developments in equipment and software capabilities permit the planning and simulation of functional occlusal movements as well as esthetic outcomes. Additional applications already include design and manufacture of removable prostheses, surgical guides, and orthodontic aligners. Current practices for monitoring patients employ analog processes that are subject to enormous variations and are vulnerable to errors in data interpretation. However, a novel software tool now allows dentists to monitor patients through 3D intraoral images combined with powerful software for data analysis (Trios Monitoring, 3Shape). Special algorithms enable the software to superimpose 3D scans recorded at different times and then calculate the time-dependent dimensional changes or structural displacements. These changes/displacements are then represented graphically and numerically, permitting easy interpretation and accurate comparison of the different scan experiences.

Minimally invasive procedures and conservative approaches are mandatory—indeed, essential—in today’s practice. The use of tracking procedures via constant monitoring might present a significantly useful clinical tool: With precise data of different clinical scenarios recorded over time, dentists can provide proper care and better decide why, when, and how to proceed when making clinical decisions. Examples of clinical applications of this novel 3D digital monitoring tool involve analysis of tooth and restorative material wear, occlusal changes, gingival recession or growth, and orthodontic tracking.
The prevalence of tooth wear is a clinical challenge to define given the inherent difficulty of obtaining precise micrometric in situ measurements. Conventional methods are limited to comparing stone casts obtained at different times, while current technology (3D scans of the patient’s dental arch with an intraoral scanner at baseline and at any subsequent appointments) permits software superimposition of the scans, resulting in precise measurement of any wear in teeth or restorations.

Orthodontic treatment progress is commonly assessed using photographs, radiographs, or measurements on stone casts. Color 3D visualization and calculation of changes in tooth position with the monitoring tool would assist not only orthodontists but also general dentists in checking treatment progress, which also improves patient education and motivation. Along with the treatment timeline created, another positive aspect is greater practice efficiencies, since the digital recording of 3D scans/images eliminates the need to archive multiple stone casts.

Gingival recession is often a prevalent esthetic and functional concern for patients with its risk of progression, and appropriate treatment must be considered. Micrometric measures of the exposed cervical area of tooth structure obtained at different periods would definitely help dentists make appropriate clinical decisions. Furthermore, gingival volumetric changes assessed by the monitoring tool software can help in the assessment of outcomes of treatments such as gingival grafts, bone augmentation, or bone substitute grafts.

In addition to the obvious clinical potential, this tool also offers clinical research potential. Prospective studies could benefit from the simplicity and reproducibility of this digital application, and numeric data assessed by measurements at different times can be used for quantitative analysis of various clinical conditions.

In summary, intraoral scanning can capture and register color clinical images in an easy and noninvasive approach at countless time intervals. Novel software algorithms are able to superimpose 3D images, calculating dimensional changes at the click of a button. The potential of 3D monitoring is immense, and with the advance of artificial intelligence and its built-in capacity for data analyses, this monitoring tool will allow dentists and researchers to precisely calculate volumetric reading and anticipate potentially adverse clinical outcomes.

RECOMMENDED READING


Current Uses of Chlorhexidine for Management of Oral Disease: A Narrative Review

Chlorhexidine (CHX) is an antiseptic mouthwash commonly used by dental practitioners and the public due to its antimicrobial effects. The aim of this article was to provide a narrative review of current antimicrobial uses of CHX relevant to dentistry in the context of oral diseases, highlighting the need for further studies to support its safe and appropriate use. Randomized controlled trials, systematic reviews, and national (UK and US) guidelines were consulted where available, with search terms for each subject category entered into the MEDLINE, PubMed, Google Scholar, and Cochrane databases. Some evidence exists to support the adjunctive short-term use of CHX to manage or prevent periodontitis, CHX must be weighed alongside its less desirable effects, including extrinsic staining of teeth, antimicrobial resistance to antiseptic agents, and the rare, but fatal, allergic reactions to CHX. Conversely, evidence for the effectiveness of CHX to manage or prevent periodontal diseases, necrotizing periodontal diseases, peri-implantitis, and infections associated with extraction and aerosolized viruses remains less certain. The use of CHX in dentistry and oral health care continues to be widespread, and thus it is important that dental practitioners understand that, based on its differential mechanisms of action on different microbes, appropriate clinical and dental use of CHX should be oral disease–specific. However, further clinical research is required before full recommendations can be made.