

Impact of Digital Technologies on Dental Materials Selection

Emily Chen*

Department of Dental Materials, National University of Singapore, Faculty of Dentistry, Singapore

DESCRIPTION

In recent years, digital technologies have transformed virtually every aspect of modern dentistry, revolutionizing how procedures are planned, executed and managed. Among the most significant areas of change is the selection and application of dental materials. Digital advancements, including Computer-Aided Design (CAD), Computer-Aided Manufacturing (CAM), 3D printing and digital impressions, have greatly influenced how materials are chosen for various dental treatments, including restorations, prosthetics and orthodontics. This technological revolution not only enhances the precision and efficiency of dental care but also provides clinicians with an expanded range of material options and facilitates the development of new, high-performance materials that meet evolving patient needs.

One of the most profound effects of digital technologies on dental material selection is the ability to improve the precision of restorations. CAD/CAM systems have enabled the fabrication of highly accurate dental restorations, such as crowns, bridges and veneers, directly from digital impressions of a patient's mouth. Traditional impressions often have issues with accuracy, which can lead to poor fitting restorations and the need for additional adjustments. However, with digital impressions, clinicians can capture highly detailed images of the oral cavity, which are then used to design and produce restorations with unparalleled precision. This shift has led to the development of new materials that are specifically engineered to perform optimally when processed through CAD/CAM systems, such as high-strength ceramics and composite resins.

Moreover, digital technologies have expanded the range of materials available for specific treatments. In the past, dentists had limited options when it came to selecting materials for restorations and prosthetics. The advent of digital design and manufacturing, however, has facilitated the creation of customized materials that offer superior aesthetics, strength and longevity. For instance, CAD/CAM technologies have made it possible to manufacture dental ceramics with enhanced properties such as improved fracture toughness and wear resistance. These advances in material science are closely tied to digital manufacturing techniques, which allow materials to be engineered for optimal performance in particular clinical

scenarios. The increased precision of digital technologies also supports the use of more aesthetically pleasing materials, such as lithium disilicate and zirconia, which are both highly durable and capable of mimicking the natural appearance of teeth.

Another significant impact of digital technologies on material selection is the ability to customize treatments based on individual patient needs. With the help of digital workflows, dental professionals can now design highly individualized restorations that take into account not only the unique anatomy of a patient's teeth but also their functional requirements. For example, using 3D imaging and software, dentists can tailor the design of a crown or bridge to optimize occlusion and bite function. This level of customization ensures that the materials selected for each patient are the best possible fit in terms of both function and aesthetics. Moreover, the ability to digitally simulate how a restoration will perform in the mouth before it is made allows for better decision-making when selecting materials, reducing the chances of failure and increasing patient satisfaction.

The integration of digital technologies has also contributed to the development of biocompatible materials. Digital scanning and modeling allow for precise analysis of how materials interact with a patient's biological tissues. This data aids in the creation of dental materials that not only offer superior strength and durability but are also highly compatible with the oral environment. For instance, advancements in digital technology have led to the creation of bioactive materials that promote remineralization of tooth structures and support gum health. These materials are particularly valuable in restorative dentistry, where longevity and biocompatibility are critical factors in treatment outcomes.

Furthermore, the efficiency of digital workflows can significantly reduce the time required for the fabrication and delivery of dental restorations. In traditional workflows, the process of taking physical impressions, creating molds and then fabricating restorations in a dental lab could take days or even weeks. Digital technologies have streamlined this process, enabling same-day restorations in many cases. This not only improves patient experience but also increases the speed with which new materials are introduced into clinical practice. Dentists can now

Correspondence to: Emily Chen, Department of Dental Materials, National University of Singapore, Faculty of Dentistry, Singapore, E-mail: emilychen@nus.edu.sg

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more easily experiment with new materials and technologies, gaining valuable insights into their performance in real-world scenarios. The rapid iteration and development of new materials facilitated by digital tools have resulted in the faster evolution of material science in the field of dentistry.

While the adoption of digital technologies in dental practices has many advantages, there are also challenges to overcome. One of the primary concerns is the cost of investing in digital systems, which can be prohibitively expensive for some dental practices. Additionally, not all materials are compatible with every digital workflow and the learning curve for mastering digital tools can be steep for some practitioners. However, as the technology becomes more widespread and costs decrease, these barriers are likely to become less significant.

CONCLUSION

In conclusion, the impact of digital technologies on dental material selection has been transformative. By enabling more precise restorations, expanding the range of available materials and facilitating customization, digital tools have improved the overall quality of care in dentistry. As these technologies continue to evolve, it is likely that new materials will emerge that are even more modified to individual patient needs, further enhancing the capabilities of modern dental practices. Digital technologies have not only reshaped how materials are selected but have also opened up exciting possibilities for the future of dental treatment and patient outcomes.