

Practical Application and Development of Digital Technology in Prosthodontics

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Abstract: The application of digital technology in prosthodontics not only improves the accuracy of restoration and the efficiency of diagnosis and treatment, but also brings more comfortable and convenient diagnosis and treatment experience to patients. It effectively promotes the rapid development of the prosthodontic aesthetics industry and leads prosthodontic technology to gradually enter a new digital era. Combining the advantages of digital technology in prosthodontics, this paper focuses on the specific applications of digital impression technology, CAD/CAM technology, network-based integrated cloud service technology, and CBCT technology in prosthodontics. On this basis, it prospects the development trend of digital technology in the field of prosthodontics, aiming to provide solid theoretical and practical support for clinical practice of prosthodontics and promote the gradual integration of the prosthodontic industry with the digital era.
Keywords: Digital technology; Prosthodontics; Practical application; Development

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1. Introduction

In the system of stomatology, prosthodontics, as an important branch, aims to restore the shape and function of the defected areas in patients' oral cavity and maxillofacial region by means of various prostheses, so as to meet the personalized psychological and physiological needs of patients. Traditional prosthodontic techniques mostly rely on manual operation, thus having certain shortcomings and drawbacks, such as cumbersome operation, long cycle, and low precision. However, in the digital and intelligent era, the rapid development of digital technology has effectively led the reform and innovation of the prosthodontic industry. It can greatly improve the quality and efficiency of prosthodontic diagnosis and design, and at the same time, provide important technical support for the accuracy and comfort of clinical application, laying a solid foundation for the digital transformation and development of the prosthodontic industry.

2. Advantages of the application of digital technology in prosthodontics

2.1. Facilitating improved restoration accuracy

As is widely known, restorations have high standards for key indicators such as contour morphology, marginal

adaptation, and occlusal relationship. With the strong support of digital technology, high-precision scanning equipment, intelligent algorithm models, and precision processing systems can significantly improve restoration accuracy and reduce processing errors through collaborative efforts, thereby ensuring that the restoration perfectly fits the patient's oral structure. This not only enhances patient satisfaction but also guarantees the long-term performance, stability, and functionality of the restoration^[1]. Compared with traditional manually fabricated restorations, digital restorations can better conform to the patient's oral tissue structure, effectively reducing the incidence of a series of complications such as secondary caries and gingivitis, which is also of great significance for prolonging the service life of restorations.

2.2. Helping enhance diagnostic and treatment efficiency

Relying on advanced digital technology, the entire diagnostic and treatment process for patients becomes faster and more efficient, especially significantly shortening the overall cycle of prosthodontics, including impression making and restoration fabrication. Traditional restoration methods require multiple procedures, such as impression material curing, model pouring, and laboratory fabrication^[2]. The entire diagnosis and treatment process is not only time-consuming but also places strict requirements on the doctor's operation. In contrast, digital impressions can complete a comprehensive scan of the patient's oral cavity in just a few minutes. Moreover, the efficiency and quality of the entire process of digital design, processing, and manufacturing can be greatly improved. This can significantly reduce the number of patient visits and waiting time, thereby effectively enhancing diagnostic and treatment efficiency.

2.3. Contributing to better patient experience

Firstly, digital impression technology can effectively overcome the drawbacks of traditional impression materials, such as unpleasant odors and discomfort, making the entire diagnostic and treatment process more relaxed and comfortable for patients. Secondly, digital systems also provide a "virtual try-on" function. In short, doctors can promptly display the restored tooth effects to patients in a three-dimensional manner, such as morphology, color, and overall aesthetics. This helps patients understand the restoration effects more intuitively and vividly, thereby enhancing their trust and recognition of doctors^[3]. During this process, if patients have questions or suggestions about the restoration plan, they can put them forward in a timely manner and participate in the formulation of the entire treatment plan, which can effectively strengthen patients' confidence in treatment.

3. Specific applications of digital technology in prosthodontics

3.1. Digital impression technology

As mentioned above, digital impression technology can quickly acquire patients' oral data with the advantages of precision and efficiency. It can be classified into different types based on scanning and imaging principles, such as contact mechanical scanning, laser scanning, and structured light scanning; and divided into direct and indirect methods according to scanning objects. The indirect method specifically refers to the use of non-contact optical scanning technology to scan models outside the mouth, through which data of dental hard and soft tissues are obtained. The direct method, also known as intraoral direct scanning, involves real-time scanning of teeth using a miniature scanner to directly capture oral information and store the 3D oral data in the system. Clinical practice shows that the direct method has obvious advantages: it not only improves scanning accuracy and allows repeated operations, but also effectively overcomes the drawbacks of traditional model data collection methods. While providing patients with a comfortable experience, it also provides solid support and guarantee for the accurate construction of 3D models^[4,5]. However, digital impression technology has certain limitations in practical

application. Especially for patients with long dental arches or edentulism, the accuracy and applicability of modeling are insufficient, limiting its scope of application. From a macro perspective, however, digital impression technology remains the mainstream oral data collection method in the current market due to its significant advantages such as high imaging accuracy. Studies have shown that the perfect combination of digital impression technology and chairside digital restoration system can not only quickly collect preparation data but also efficiently fabricate restorations, thus its position in the field of prosthodontics is unshakable.

3.2. CAD/CAM technology

Nowadays, the seamless integration of CAD/CAM systems with computer-aided rapid prototyping technology, combined with big data and cloud diagnosis technologies, can meet the needs of various denture processing and clinical application requirements of other dental specialties. The collaborative operation of CAD/CAM technology and other oral digital equipment enables the immediate fabrication of restorations. More importantly, with the help of 3D reconstruction technology, real teeth can be designed on a 1:1 scale, ensuring that the fabricated restorations can more accurately and realistically restore the contact and occlusion relationships with other teeth. To enhance the stability of oral restoration and improve aesthetic outcomes, CAD/CAM technology can also be tailored to individual patient differences. Based on personalized abutment milling plans, it can produce dentures that meet patients' needs with better aesthetics and adaptability^[6]. Studies have shown that the application of CAD/CAM technology in the field of fixed restoration has become mature.

Restorations fabricated based on this technology not only have better marginal adaptation but also higher adaptability and retention rate. Even with long-term wear, patients rarely experience color differences, and the probability of restoration fracture or damage is low. Of course, this technology also has certain drawbacks in practical application. For example, its research and clinical application effects in the field of removable restorations such as removable partial dentures and complete dentures need further exploration and are not yet significant^[7].

In summary, although CAD/CAM digital technology is not fully mature in the field of prosthodontics, it can effectively reduce the workload of dentists, improve restoration accuracy, and enhance safety and efficiency.

3.3. Network-based integrated cloud service technology

Integrated cloud service technology provides strong technical support for data sharing and communication between patients and physicians. It enables patients to promptly access relevant diagnosis and treatment information via the network, and facilitates physicians to communicate surgical key points with patients anytime and anywhere. This allows physicians to allocate more time and energy to meticulously design oral restoration plans, further improving patient satisfaction. With the strong support of cloud service technology, diagnosis and treatment data can be stored in the cloud, while interconnection and interoperability can be achieved between various digital devices. This not only facilitates the timely control of devices but also enhances the efficiency of information transmission.

Moreover, integrated cloud service technology can provide powerful technical support for remote monitoring throughout the oral restoration process. After information is transmitted to the central system, the system can efficiently organize the information and issue precise instructions, thereby greatly improving the treatment efficiency of oral restoration. Specifically, supported by cloud service technology, patients' medical scanning image data can be transmitted to physicians in real-time. Physicians can then view the information through the information management system and design targeted plans. Technicians can also receive oral impression data sent by digital scanners in real-time. Based on understanding the patient's tooth morphology and arrangement, they can use computer-aided software to complete the 3D animation design of restorations^[8,9].

Through remote management, technicians, physicians, and patients can achieve barrier-free communication, thereby improving the production efficiency of restorations, shortening the time, ensuring close communication

between doctors and patients, and fundamentally avoiding conflicts.

3.4. CBCT technology

Against the backdrop of the new era with the continuous emergence of advanced science and technology, the diagnosis and treatment of oral restoration have gradually transitioned from the 2D era to the 3D era. Compared with 2D imaging technology, 3D reconstruction imaging technology can present the complex anatomical relationships of various tissues in the patient's oral cavity in a three-dimensional and precise manner, which can specifically make up for the disadvantage of diagnostic errors caused by image overlap in 2D imaging. CBCT technology has significant advantages and can meet the 21st-century human demand for precision and minimal invasiveness in oral restoration^[10].

This technology can provide physicians with comprehensive oral information, which is conducive to providing a scientific basis for formulating personalized surgical plans and greatly improving the success rate and accuracy of restoration surgeries. Compared with traditional CT technology, CBCT technology has more prominent advantages. For example, images taken by CBCT technology can more clearly and intuitively show oral conditions, such as residual bone volume and periodontal diseases. This can improve the accuracy of bone volume measurement and the success rate of implant surgery, and further eliminate the negative impact of inflammation caused by periodontal diseases on restoration plans^[11].

Studies have shown that CBCT technology can provide detailed preoperative predictions for a variety of periodontal diseases, such as external root resorption, pulp and periapical diseases, impacted teeth, and vertical root fractures, and clarify the scope of lesions. This provides guidance and a correct direction for physicians to perform oral restoration surgeries, further reducing the damage to tissues and nerves in the lesion area caused by surgery, thereby greatly improving the success rate and safety of oral restoration surgeries. In addition, CBCT technology has high imaging quality, which is conducive to displaying the internal state of the oral cavity more clearly and accurately. It allows physicians to carefully understand the fine anatomical structures in the oral cavity based on the images, while clarifying the position of wisdom teeth and understanding the direction of the mandibular nerve canal, thus providing a scientific basis for physicians' clinical operations.

However, CBCT technology also has certain limitations in clinical application. For instance, due to the low density of soft tissues, the clarity of images obtained by CBCT technology may not meet the ideal effect, and artifacts may appear during the imaging process based on CBCT technology, which may affect the accuracy of physicians' diagnosis of patients' oral conditions^[12,13].

4. Development prospects of the practical application of digital technology in dental prosthetics

As can be seen from the above, digital technology is widely applied in the field of dental prosthetics, and each technology shows distinct advantages and disadvantages. The practical application of digital impression technology, CAD/CAM technology, network-based integrated cloud service technology, and CBCT technology in dental prosthetics plays a positive role in improving the accuracy of diagnosis and treatment, operational convenience, as well as patient satisfaction and comfort^[14]. However, at present, the application of many digital technologies in dental prosthetics is still in the exploration stage, with low technical maturity and functions to be further developed, thus presenting broad development prospects. In the future, emerging technologies such as ultra-high-speed 3D printing and three-dimensional bioprinting may trigger major revolutions in the field of clinical dental technology, and at the same time, may also promote the continuous innovation of concepts; some technologies may have a disruptive impact on existing technologies^[15,16].

Moreover, the digital impression technology, CAD/CAM technology, network-based integrated cloud service technology, and CBCT technology mentioned in this paper will continue to develop in the direction of high precision and standardization in the future, aiming to provide patients with better and personalized services.

5. Conclusion

In summary, this paper focuses on discussing the advantages of the application of digital technology in dental prosthetics, elaborates on the specific applications of digital impression technology, CAD/CAM technology, network-based integrated cloud service technology, and CBCT technology in the field of dental prosthetics, and also looks forward to the relevant development directions. In the future, dental medical workers should keep pace with the times, pay real-time attention to the innovation and development of digital technology, and strengthen the research and practice of its application in the field of dental prosthetics, aiming to promote the digital transformation of the entire dental industry as soon as possible and provide better and more efficient services for the majority of patients.

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References

- [1] Xie L, 2024, Practical Application and Development of Digital Technology in Dental Prosthodontics. *Digital Communication World*, 2024(12): 175–177.
- [2] Li H, 2024, Discussion on the Clinical Application Value of Oral Digital Technology in Dental Prosthodontics. *Proceedings of the 7th National Academic Conference on Rehabilitation and Clinical Pharmacy*, 1–7.
- [3] Wang B, Fang W, Yu Y, et al., 2025, Research Progress on the Application of Digital Impression Technology in Dental Prosthodontics. *Contemporary Medicine Forum*, 23(3): 13–17.
- [4] Zheng X, 2024, Analysis of the Application Value of Oral Digital Technology in Clinical Dental Prosthodontics. *Heilongjiang Journal of Traditional Chinese Medicine*, 53(4): 69–70.
- [5] Qiu J, 2021, A Series of Case Reports on the Application of Digital Technology in Dental Prosthodontics, thesis, Fujian Medical University.
- [6] Qi H, 2023, Discussion on the Clinical Application Value of Oral Digital Technology in Dental Prosthodontics. *Smart Healthcare*, 9(11): 35–38 + 46.
- [7] Zhang X, Chen C, Zhang R, 2022, Research on the Application of Digital Technology in Dental Prosthodontics. *World Journal of Composite Medicine*, 8(10): 37–39 + 146.
- [8] Xue W, Bao Z, Yang Y, 2022, Application Effect of Digital Impression Technology in Dental Prosthodontics. *Clinical Research and Practice*, 7(22): 110–112.
- [9] Deng J, Fan Q, 2021, Application of Oral Digital Technology in Dental Prosthodontics. *Contemporary Medicine Forum*, 19(21): 51–54.

- [10] Sun P, Xu L, Hu J, 2022, Application of Digital Smile Design Technology in Aesthetic Teaching of Prosthodontics. *Zhejiang Medical Education*, 21(3): 179–183.
- [11] Li X, 2021, Discussion on the Clinical Application of Oral Digital Technology in Dental Prosthodontics. *Health Care Guide*, 2021(28): 80.
- [12] Yang X, 2021, Analysis of the Application Effect of Digital Impression Technology in Dental Prosthodontic Treatment. *Health Care Guide*, 2021(42): 9–10.
- [13] Gong Y, 2021, Analysis of the Clinical Application of Oral Digital Technology in Dental Prosthodontics. *Health World*, 2021(14): 149.
- [14] Yang Z, Mao F, 2020, Clinical Application Effect of Oral Digital Technology in Dental Prosthodontics. *Journal of General Stomatology (Electronic Edition)*, 7(6): 44.
- [15] Zhang L, 2020, Clinical Application Effect of Oral Digital Technology in Dental Prosthodontics. *Journal of General Stomatology (Electronic Edition)*, 7(2): 96 + 105.
- [16] Wang G, 2021, Effect of Oral Digital Technology in Dental Prosthodontics and Its Influence on Patients' Aesthetic Satisfaction. *Chinese Journal of Medical Innovation*, 18(30): 67–71.

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