Journal of Computers Vol. 35 No. 2, April 2024, pp. 199-213
doi: 10.53106/199115992024043502013

The Application Strategy of Oral Digital Technology in Clinical and Teaching of Oral Restoration

Zhong-Hua Zhao, Yuan-Jie Wang, Zhi-Hua Zhao, Li-Bo Ku*

Tangshan Vocational & Technical College,
Tangshan City 063300, Hebei Province, China
{zhonghua8826, yuanjie0023, zhihua20080707, libo20120823}@126.com

Received 27 March 2024; Revised 3 April 2024; Accepted 15 April 2024

Abstract. Digital oral technology is currently the main development direction of oral restoration, which can improve treatment efficiency and enhance the accuracy of dental models. This article focuses on the application of digital oral technology. Firstly, it describes the advantages of digital technology in obtaining oral data, and discusses the methods of obtaining dental models and oral data. The obtained data is statistically analyzed and compared with traditional measurement methods. The comparison results show the advantages of digital oral technology, and further elucidate the application strategies of oral digitization. Then, regarding the teaching issues of oral digital technology, a survey questionnaire was used to explore the advantages and roles of oral digital technology in the classroom, as well as the attitudes of students towards new courses. Based on the current teaching situation, strategies were formulated for teaching application, mainly clarifying the content planning and future development direction of the course, which has good guiding significance for the clinical and teaching implementation of oral digital technology.

Keywords: digital oral, dental model, oral teaching

1 Introduction

With the increasing improvement of people's living standards, there have been structural changes in dietary habits and structure, and the oral health problems caused by diet have become prominent. The treatment of oral diseases has also shifted from traditional treatment methods to customized digital treatment methods. Digital technology has the characteristics of intuitiveness, virtuality, and interactivity, which can improve the work efficiency of dental technicians and bring broad prospects for the development of dental restorative medicine technology.

Oral computer-aided design and computer-aided manufacturing technology [1] is a key technology for intraoral digital impression, which is increasingly applied in the field of oral medicine such as dental restoration, dental implantation, and orthodontics. Oral digital impression technology is the foundation of the digital development direction of oral medicine [2]. The traditional oral impression method requires selecting a suitable impression tray. Firstly, the impression material is placed on a disinfected tray. During the impression process, the tray is placed in the patient's mouth, and then the impression material is deformed by pressure. Finally, wax is poured into the impression to complete the impression [3]. From the above process, it can be seen that traditional impressions require a longer time to obtain the final dental impression, The accuracy of the dental model obtained depends entirely on the technical level and experience of the staff. Therefore, from the patient's perspective, it is an undeniable fact in the field of dentistry that not only cannot obtain more precise dental models, but also needs to endure longer periods of toothache and participate in longer treatment cycles.

Gypsum dental molds are the fundamental information for orthodontic treatment. Before the formal start of traditional orthodontic treatment, the model needs to be measured and analyzed. Traditional orthodontic treatment generally uses manual measurement methods, which have poor repeatability and measurement accuracy [4].

With the development of computer-aided technology, the development of three-dimensional digital scanning technology has opened up a new direction for oral clinical work. The use of three-dimensional scanning systems to convert solid gypsum models into digital models to obtain dental model data models is not only convenient for storage and measurement, but also solves problems such as large space occupation, easy damage, and low transmission efficiency of gypsum models.

* Corresponding Author

In summary, in order to illustrate the difference between digital oral restoration technology and traditional oral restoration technology, this article elaborates on the application strategy of digital oral technology from the perspectives of manual measurement and digital measurement of orthodontic models [5].

Summarizing the conventional treatment methods and current problems in clinical practice can help explore innovative research points. In addition, with the transparency of the domestic college entrance examination major, oral medicine, as a popular major, is increasingly favored by students and parents. As a vocational and even university professional course, oral medicine requires a reasonable and efficient curriculum planning and promotion methods to cope with the explosive growth of student population and fully prepare for the cultivation of suitable oral workers in society.

1) The traditional silicone and gypsum dental molds have a long production cycle, which leads to an extended oral repair cycle and increases the waiting and pain tolerance time for patients.

2) In terms of accuracy, in traditional oral restoration processes, the measurement accuracy of dental molds is poor, which often results in restoration results that do not match expectations.

3) Traditional oral restoration methods do not save enough data during the restoration process, making it difficult to establish a unified patient data archive. With the development of artificial intelligence technology, it has brought disruptive changes to many fields, and artificial intelligence requires datasets as the foundation. Therefore, the application and development of artificial intelligence technology in the clinical field of dentistry require the accumulation of a large amount of digital oral data [6].

Therefore, the composition of this article is as follows: Chapter 2 mainly introduces the research on digital measurement strategies for dental models, Chapter 3 discusses how to promote digital oral restoration technology in teaching, and Chapter 4 explores the application strategies of courses from the perspectives of course design and evaluation. Chapter 5 is the conclusion section.

2 Measurement Strategy for Dental Model

For the measurement of dental models, it can be divided into traditional measurement methods and digital measurement methods. A window type impression column and a disposable plastic finished tray are used to prepare the final impression mold for planting and restoration in the mouth of the subjects. A one-step method is used to make the final impression mold for planting and restoration using silicone rubber material, and the model is perfused with ultra hard gypsum according to the standard operating procedure. The traditional method of measuring dental models uses conventional measuring tools such as vernier calipers to obtain basic data, while the digital measurement method inserts ISB onto the obtained gypsum model implant and uses a Trios 3 scanner with a 3-shape to perform optical scanning on the model. Save the obtained data in the corresponding format in the software for data saving. With the development of technology, a more advanced means of obtaining oral data is to connect the ISB to the implant in the subject's mouth and apply a torque of 15 N · cm, with the oblique plane of the ISB facing the buccal side. The Trios 3 scanner with a 3-shape was used for oral scanning to obtain data. Based on the clinical popularity and cost of use, this article mainly analyzes the data obtained by conventional measurement methods and digital scanning methods after obtaining dental impressions, and compares the acquisition methods [7].

The overall technical flowchart of model measurement is shown in Fig. 1.

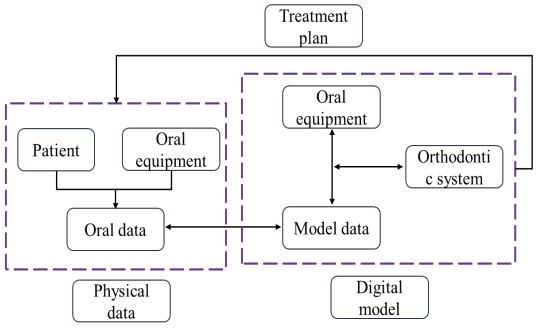

Fig. 1. Overall technical flowchart for model measurement

2.1 Data Acquisition Methods

For the data measurement of traditional dental models, the staff first followed the operating procedures to perform routine polyether rubber imprinting on volunteers and then filled them with gypsum models. For the data measurement of digital dental models, it is necessary to place the volunteer polyether rubber impression filled gypsum model on the scanner workbench for digital scanning, start the scanning program, obtain the final digital model, and store it in STL format. The measurement method is as follows:

1) Select the natural dentition in the model separately, and use CBCT and optical scanning to register the natural dentition, achieving the fitting of two different data;

2) Fit and register the ISB data of the registration reference with the scanned ISB data, and use the common data of this part to include the registration reference of the corresponding length of the patient in the same coordinate system as the CBCT reconstructed implant;

3) Parameterize the CBCT reconstructed implant with the implant determined by the registration reference for subsequent difference comparison. The digital registration method utilizes the iterative closest point (ICP) algorithm of 3D reconstruction software to calculate errors in the accuracy measurement process. Research has shown that there is no statistically significant difference in measurement accuracy compared to CBCT method, and it can be applied in clinical practice.

Based on the above three-dimensional model data and measurement methods, further use the pre scanned and reconstructed registration reference to calculate the various parameter information of the implant. Import the data obtained from the traditional method and digital impression method into the software, fit the implant data into a cylinder, and record the upper and lower vertices and major axis direction of the cylinder in the spatial Cartesian coordinate system to avoid errors caused by manual positioning. After fitting the dental data with the postoperative implant position determined by CBCT reconstruction as a reference, compare and analyze the deviation between the implant position determined by the two methods and the reference position. Calculate the distance deviation of the implant at the implantation point, root apex point, and other locations, as well as the angle deviation of the implant's long axis.

The measurement items are shown in Table 1.

Table 1. Parameters and names required for dental model data measurement

Data name	Symbol
The total width of the crowns of four upper incisors	l_0
Anterior arch width	l_1
Maxillary bilateral canine apex spacing	l_2
Posterior arch width	l_3
The length of the anterior segment of the dental arch	l_4
The length of the posterior segment of the dental arch	l_5
Implant implantation site	P_a
Apical point	P_b
Angle	α
The distance between the midpoint of the central fossa of the bilateral first permanent molars in the upper jaw	l_6
The distance between the contact point of the central incisor and the midpoint of the central fossa of the right first permanent molar	l_7

Perform statistical analysis on the data obtained above using SPSS 21.0 software. Paired tests were used to analyze the deviations in implant implantation points, apical points, and angles measured by traditional and intraoral scanning digital impression methods. For measurement and testing data, if some of the data deviates from the average value, it is generally referred to as "suspicious value". To find this value, scholars established the Grabbs test method. The Grabbs test can be divided into two types: one is an outlier observation test, and the other is two outlier observation tests. An outlier observation test refers to arranging the statistical test data A in ascending order to obtain the permutation prime group B, and using the Grabbs one-sided test method to determine whether the maximum observation value is an outlier. The calculation method is as follows:

$$G_p = \left(X_{\max} - \bar{x} \right) / \left(\sqrt{\frac{1}{p-1} \left(\sum_{i=1}^{p} \left(x_i - \bar{x} \right)^2 \right)} \right). \quad (1)$$

The minimum inspection method is:

$$G_p = \left(-X_{\min} + \bar{x} \right) / \left(\sqrt{\frac{1}{p-1} \left(\sum_{i=1}^{p} \left(x_i - \bar{x} \right)^2 \right)} \right). \quad (2)$$

When the statistical result is A, it is considered that the difference data is meaningful. Multiple subjects were selected from a large number of patients, and data from 20 subjects were obtained through data screening. The implantation point, cusp point, and angle were selected as the research objects, and the data comparison is shown in Table 2.

Table 2. Data comparison

Method	Implantation point (mm)	Apical point (mm)	Angle (°)
Traditional method	0.735±0.301	1.024±0.291	2.903±0.92
Digital methods	0.747±0.213	1.063±0.268	1.684±0.266

The positional deviation of the implantation point and apical point of digital impression implants is not statistically significant compared to traditional methods. According to Semper's research results, the Straumann implant abutment can accept an angle deviation of up to 3.7° [8]. In this study, the digital impression method was used to measure the implant angle deviation, which was 1.684°, while the traditional impression method was 2.903°. The angle deviation measured by both methods was within this acceptable range. The possible reason for the difference in angle between the two methods is that the traditional impression material has a certain elasticity, which can cause slight displacement when the tray is dislocated, leading to errors. In the process of preparing implant impressions in clinical practice, non-window type is a common impression method, especially in short span dental arches [9]. During the connection process between the transfer rod and the impression, displacement is prone to occur. Studies have shown that when the number of implants is greater than 3 or the inclination angle between implants is greater than 10°, the error is greater than that of window type. The use of ISB intraoral scanning digital impression can reduce errors caused by the complex manual operation of traditional impression methods. From this, it can be seen that for the final impression of short span missing tooth implantation, although both traditional and digital impression methods can meet clinical needs, digital impression methods have more advantages and are more convenient for implantation [10].

Reducing the error of implant impressions can reduce the occurrence of clinical complications after implant restoration, which has become a consensus among clinical doctors. However, the specific error range cannot be determined at present. Previous studies have mainly been conducted in vitro, and the error range determined by different measurement methods also varies. Currently, most scholars agree that the accuracy of digital impressions of implants is comparable to that of traditional impressions in short span dental arches. Compared with traditional impression technology, digital impression technology can alleviate the discomfort of patients during mold retrieval, without the need for injection of plaster models and without affecting accuracy due to the quality of impression materials, nor does it require specialized storage of models. In addition, the accuracy of optical scanning is constantly improving. Nevertheless, digital impression technology still has many limitations such as mouth opening, saliva, cost, and operator technical sensitivity. However, with the development of technology, these limitations will inevitably be well resolved.

2.2 Application Strategy of Digital Oral Technology

The digital scanning of dental models improves patient comfort and avoids errors caused by material properties during the model making process. However, when the dental arch in the oral cavity is complex, the intraoral scanner is prone to blind spots due to excessive saliva, occlusion of adjacent teeth, or restricted mouth opening. Research has shown that when the intraoral scanning range is within 1/2 of the dental arch, the accuracy of the digital model obtained is higher, while the intraoral scanner is not limited by the scanning range of the dental arch [11]. The reliability, effectiveness, and consistency of the digital model obtained by scanning the plaster model are higher than those obtained by intraoral scanning. But from the current application perspective, the advantages of digital scanning are more obvious:

1) Stomatologists can measure various parameters of digital models in real-time, and can also segment the models on software, allowing them to observe teeth and oral anatomical structures on any cross-section. They can also choose more accurate contact points between the proximal and distal teeth, which can also be used in teaching and explanation.

2) The tool plugins included in the digital scanning software accurately and quickly segment tightly arranged teeth, and then rearrange them to visually observe the final treatment effect. If necessary, the operation can be repeated until the desired effect is achieved. At the same time, the previous operation can be undone to restore the original state of the digital model, without causing damage to the model, with high accuracy, simple and convenient.

3) The operator can measure various parameters of the digital model in real-time, and can also segment the model on the client or even on the simulation webpage, allowing for the observation of teeth and oral anatomy on any cross-section. The selection of contact points between the near and far teeth is also more accurate, which is difficult to achieve with traditional gypsum models. The conventional measurement methods can only ensure high accuracy when measuring linear dimensions, but it is relatively difficult to measure angles and areas. On the digital model, the area and volume of relevant areas can also be measured, thereby obtaining more comprehensive model information. Moreover, on the digital 3D dental model, the occlusion relationship can be checked unobstructed from any angle in the 3D space, ensuring more comprehensive and accurate information in the early stage of orthodontic treatment [12].

4) The use of digital models for dental alignment experiments is efficient and convenient. The tightly arranged teeth are accurately and quickly segmented using tools in the tool library, and then rearranged to visually observe the final treatment effect. If necessary, the operation can be repeated until the desired effect is achieved, without causing damage to the model and with high accuracy. In terms of reuse, traditional methods are not comparable.

5) Accurate prediction of root position changes during orthodontic treatment is a key factor in the success of orthodontic treatment. Although CBCT can provide accurate root information, the radiation dose of CBCT is significantly higher than that of conventional X-rays. It is not recommended to use CBCT as a substitute for conventional X-rays during orthodontic treatment.

6) The establishment of digital models provides a new method for evaluating the effectiveness of orthodontics. After obtaining the digital models for each treatment stage, software can be used to adjust and combine the models, observe and analyze them in three-dimensional space, objectively evaluate the treatment effect of orthodontic treatment, and provide guidance for the next orthodontic plan. After orthodontic treatment is completed, the digital models can be used as memory data, dataset data, and scientific research data accumulation, all of which are useful.

7) In the process of orthodontic treatment, traditional treatment plans cannot accurately predict the treatment effect, reducing the transparency of treatment and causing patients to lack an accurate expectation. The use of three-dimensional digital technology can reconstruct complex orthodontic processes, measure and analyze relevant data on the reconstructed model, and if necessary, perform surgical simulations to better prepare for surgery and predict postoperative outcomes.

8) For the modeling of special populations, such as children with cleft lip and palate or patients who require removable denture restoration after surgery for oral and maxillofacial malignant tumors, it is difficult to use traditional modeling methods. It is also possible to consider using intraoral scanners to obtain digital models.

Therefore, the process of digital oral technology in clinical application is shown in Fig. 2:

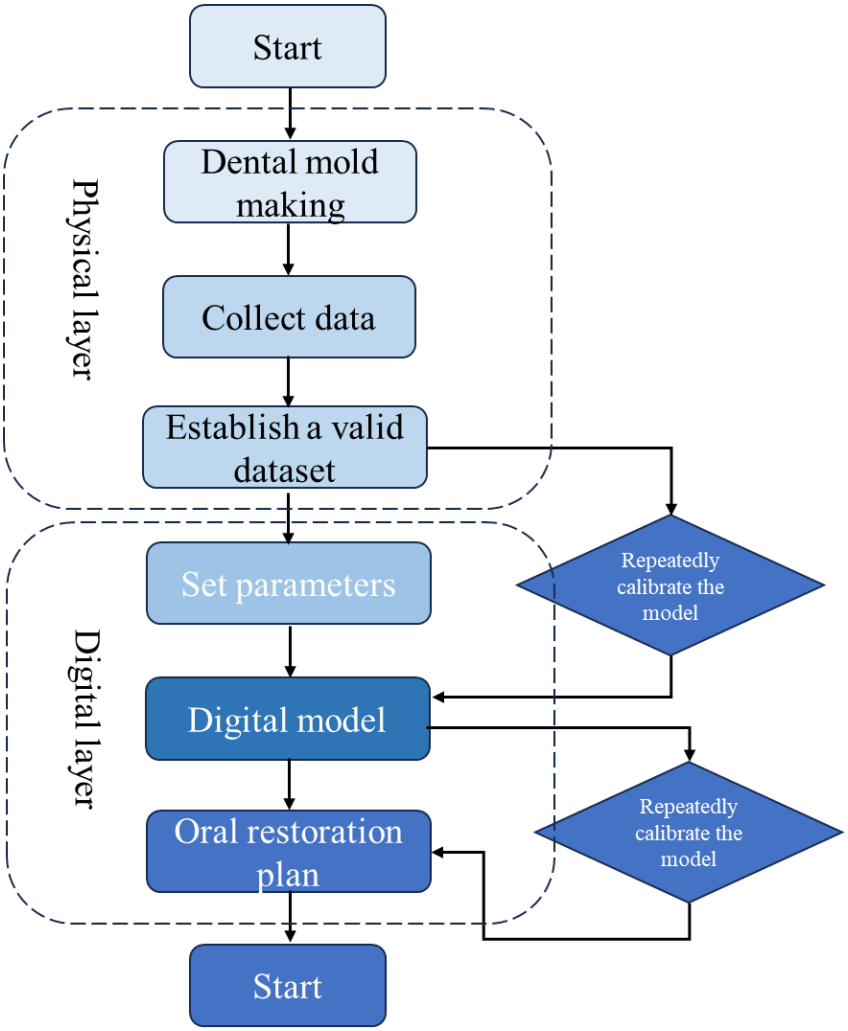

Fig. 2. Overall technical flowchart for model measurement

3 The Application of Digital Oral Technology in Oral Education

Based on the current oral diagnosis and treatment plan, digital oral technology has significant advantages in the application process. In order to promote digital oral technology, this article combines the characteristics of domestic vocational education to discuss the application strategies of digital oral technology in the teaching process.

In traditional oral restoration courses, students mainly rely on plaster models to understand and analyze sub models, which can lead to a lack of in-depth understanding of teeth and maintain stereotypes [13]. At the same time, traditional teaching methods are not flexible enough in mastering theoretical knowledge of teeth, understanding some knowledge points, especially the content that needs to be analyzed and distinguished, and there is a disconnect between theory and clinical practice, lacking systematic and organic integration of knowledge. In order to compare the differences between traditional oral restoration methods and digital oral restoration methods in the teaching process, this article uses a survey questionnaire to investigate and analyze the teaching effects of the gypsum dental model and digital dental model used in the course content. Then, the feedback results of the questionnaire are compared and discussed. The survey questionnaire is designed as shown in Fig. 3.

The Application of Digital Oral Technology in the Teaching Process

Hello, Dear classmates! This questionnaire aims to understand your feelings and suggestions regarding the use of digital dental models in the teaching section of the course, as well as the use of simple reading based learning in online courses, in order to help the teacher better carry out teaching work for you. This questionnaire is anonymous and there is no distinction between right and wrong, good or bad options. It is only for reference by the instructor, so you do not need to have any concerns. Please tell us your true thoughts. Thank you for your cooperation! (Please mark "√" on the alternative answers or fill in the options directly) Note that the teaching mode adopted in this class refers to the simple reading style learning online course teaching mode we adopted in the removable partial denture clasp design class.

* 1. Compared to traditional teaching methods, can digital technology better help you understand the structure of teeth during the teaching process?

- ○ Yes
- ○ No
- ○ Not Sure

* 2. Compared to gypsum dental molds, can digital oral dental molds truly reflect the characteristics and key points of dental anatomy?

- ○ Yes
- ○ No
- ○ Not Sure

* 3. Compared with traditional teaching methods, digital technology can be more convenient to view and learn on mobile devices, making it more convenient and convenient.

- ○ Yes
- ○ No
- ○ Not Sure

* 4. What is the clarity of the digital oral model you are viewing during display?

- ○ Relatively poor
- ○ The effect is average
- ○ Good effect
- ○ Very good

* 5. Do you wish to continue using 3D digital software for future oral courses?

- ○ Yes
- ○ No

* 6. How much attention do you pay to 3D digital courses compared to traditional classroom teaching?

- ○ More focused attention
- ○ Easy to lose focus
- ○ Almost

* 7. From the current teaching effectiveness, can 3D digital models replace traditional dental model teaching aids?

- ○ Yes
- ○ No
- ○ Not Sure

* 8. After using digital models, do you have a better understanding of oral structure compared to traditional dental models?

- ○ Clearness
- ○ Vague
- ○ Almost

* 9. Has the teaching mode adopted in this class improved your learning motivation?

- ◯ Clearness
- ◯ Vague
- ◯ Almost

* 10. Has adopting this teaching mode increased your interest and opportunities to discuss with classmates?

- ◯ Clearness
- ◯ Vague
- ◯ Almost

* 11. What is the main way you receive knowledge using this teaching model?

- ◯ Proactively accepting
- ◯ Passive acceptance

* 12. Do you mainly master knowledge through memorization or comprehension when using this teaching mode?

- ◯ recite
- ◯ understanding

* 13. What is your learning burden after adopting this teaching mode?

- ◯ Aggravated
- ◯ Reduced
- ◯ No significant changes

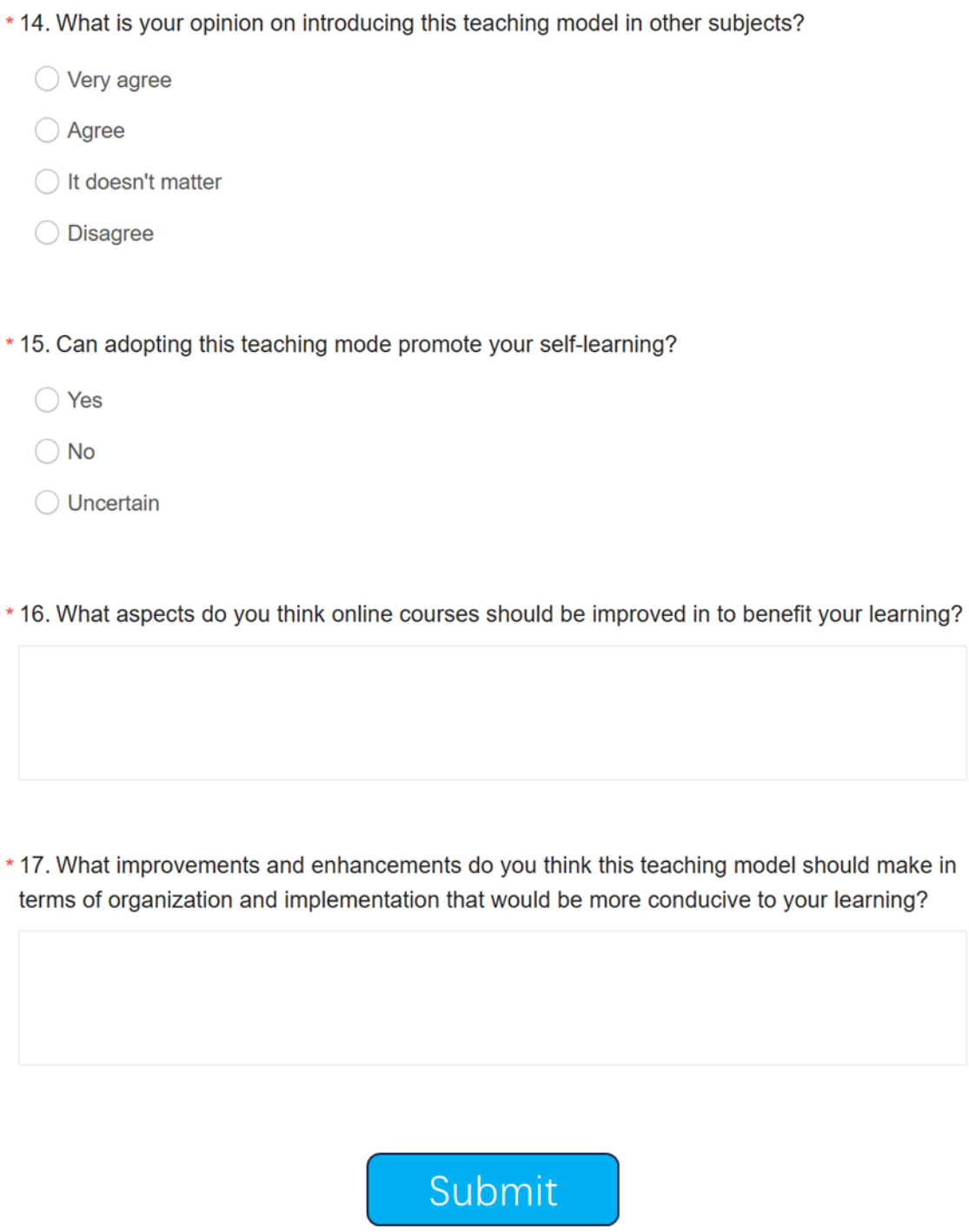

Fig. 3. Survey questionnaire

Selecting two teaching arrangements during the semester [14], after the end of the classes, a total of 47 questionnaires were distributed to students in relevant majors of our school, and 44 valid questionnaires were collected with a response rate of 96.2%. The overall evaluation of the application of digital means in teaching and traditional teaching methods by students is shown in Table 3.

Table 3. Survey questionnaire results statistics

Questionnaire content	"Yes"	"No"	"Not Sure"
Digital technology is more helpful in understanding tooth structure than traditional technology	84%	2%	14%
Digital technology can better reflect the anatomical structure of teeth than traditional technology	93%	0	7%
More convenient for learning on electronic and mobile devices	95%	0	5%
Clear display effect	79%	10%	11%
Hope to continue using 3D models	77%	8%	15%
High classroom focus on 3D digital courses	84%	3%	13%
3D digital models can replace traditional dental molds	86%	2%	12%
Can better learn oral theory	91%	0	9%

The results showed that the majority of students highly agree with digital classrooms, and 93% of students believe that three-dimensional dental anatomy models can replace traditional models in the teaching process. From the statistical results, it can be seen that some students oppose continuing to use 3D digital models. The reasons for this may be as follows: because digital courses are two experiential courses, the content is not coherent enough, and the advantages of digital courses are not fully utilized. In addition, students are not proficient enough in using digital models.

4 The Application Strategy of Digital Oral Technology in Clinical and Teaching of Oral Restoration

The second and third chapters discuss the application of digital dentistry in practice and teaching. Compared with traditional oral restoration technology, digital dentistry technology has obvious advantages. In order to promote digital dentistry restoration, it is necessary to improve the teaching strategies of relevant majors in domestic universities and expand the scope of digital dentistry technology. This section mainly introduces the course design methods of digital oral technology in the curriculum, and based on this, discusses future opinions on digital oral teaching.

4.1 Course Content Design

This article takes the teaching content of the seventh edition of Orthodontics as an example. The theoretical knowledge section consists of the first 14 chapters. The teaching staff will use offline multimedia teaching, 3D software and 3D animation demonstrations, online MOOCs, and other online and offline blended teaching methods to systematically explain basic theoretical knowledge chapter by chapter according to the requirements of the training plan and teaching outline. The teaching teacher provides one to two post class reflection questions at the end of each chapter to assess the student's learning situation [15].

In the first stage, Chapter 5 of the textbook focuses on the examination and diagnosis of malocclusion. After introducing digital oral technology, two experimental classes were conducted to familiarize students with the process of collecting case data and lay a foundation for the subsequent case presentation. The content of the experimental class revolves around the examination and diagnosis of malocclusion, and the operating platform is a three-dimensional digital platform. Specific implementation method: The first experimental class was orthodontic clinical examination, medical record writing, and work model creation. Form a group of two students and exchange memory models for each other. The second experimental class was model measurement, and students were also grouped to measure the objects using plugins in 3D software.

In the second stage, the teaching teacher will inform students that after the theoretical class, there will be one or two class case discussions, using PBL and CBL teaching methods. The teaching teacher requires students to develop an orthodontic plan for patients by combining the knowledge they have learned and the information they have consulted with patient case data. The orthodontic plan should be combined with a three-dimensional

model, and the preoperative, intraoperative, and postoperative effects should be displayed. The reasons for each treatment step should be written, and the specific devices used to solve the problems should be presented in the form of a report. The teaching teacher will divide the students into three groups and select one group leader to be responsible.

In the third stage, each group selects a representative to explain the case of their group during the case discussion class, including introducing the patient's situation and presenting a list of questions and treatment methods, as well as explaining the reasons for choosing this treatment method. The other two groups of students can ask questions and discuss if they have different opinions.

The fourth stage is course evaluation. Course evaluation is a summary report of the course implementation, which quantitatively reflects the effectiveness of student listening. For digital oral teaching, this article designs a course evaluation system.

4.2 Course Evaluation Mechanism

This evaluation index system starts from the perspective of students participating in oral digital teaching and learning activities, reflecting their learning attitude, mutual communication, resource utilization, and other situations when participating in learning. It solves the problem of too many evaluation indicators in the current evaluation system, some of which overlap and are difficult to achieve timely evaluation. It is worth noting that the non quantitative evaluation indicators focus on various learning behaviors of students during the learning process, which reflect factors that cannot be quantified, such as learning attitudes, learning methods, resource utilization, and interaction levels [16].

Due to the fact that the performance of student digital oral courses is a combination of multiple characteristics, where each characteristic factor is expressed by an indicator (set) in the evaluation index system, and the characteristic factors are often heterogeneous, and multiple evaluation indicators (sets) are also heterogeneous. The application strategies are as Table 4:

Table 4. Survey questionnaire results statistics

Primary indicators	Secondary indicators	Third level indicators
Knowledge acquisition	Knowledge mastery level	Average grade of homework Self test average score Average score of online exams
Collaborative communication	Interactive enthusiasm	Total forum browsing time Number of forum publications Number of questions raised
	Interaction quality	Forum views Number of forum replies received Number of forum essence stickers Number of times participating in Q&A
Learning attitude	Punctuality	Submit homework on time
	Participation level	Self testing frequency Number of homework submissions Number of online exams
	Resource utilization situation	Total time spent browsing courseware Total number of times browsing courseware Number of chapters for browsing courseware

The evaluation process is as follows:

The first step is to trend. In comprehensive evaluation, some indicators are high performance indicators, while others are low performance indicators. When evaluating, it is required that all indicators have the same direction. Usually, low optimization indicators are optimized high. Take the negative value or reciprocal of the optimal indicators in the original data.

The second step is to make the indicators dimensionless. In order to eliminate the influence of measurement units on indicators, it is necessary to normalize the measured values of indicators, that is, dimensionless. The normalization matrix is represented as [17]:

$$G_{ij} = \frac{T_{ij}}{\sqrt{\sum_{i-1}^{n}\left(T_{ij}\right)^2}}. \quad (i = 1,2...n, j = 1,2...m) \tag{3}$$

Step three, find the optimal and worst solutions among the finite solutions. If the original data is uniformly trended to a high optimal indicator, the optimal solution is expressed as:

$$F_{you} = \left(a_{i\max}...a_{n\max}\right). \tag{4}$$

The worst-case scenario is represented as:

$$F_{lie} = \left(a_{i\min}...a_{n\min}\right). \tag{5}$$

Step 4, calculate the degree of closeness between each evaluation object and the optimal and worst solutions:

$$t = \frac{\sqrt{\sum_{i=1}^{m}\left(a_{ij\min} - a_{ij}\right)^2}}{\sqrt{\sum_{i=1}^{m}\left(a_{ij\max} - a_{ij}\right)^2} + \sqrt{\sum_{i=1}^{m}\left(a_{ij\min} - a_{ij}\right)^2}}. \tag{6}$$

The greater the proximity, the better the evaluation result. Simulate and program the above process using Matlb, and the programming code is shown in Fig. 4:

```
%macro topsis(data_name,var_name,var_keep=&var_name,weight=0);
%let i=1;
 %do %until(&&var&i=);
   %let i=%eval(&i+1);
   %let var&i=%scan(&var_name,&i,' ');
%else%do;
   data top_1;
   set &data_name;
   data top_2;
      %do i=1 %to &var_num;
      &&var&i=1;
      %end;
data top_d;
   set top_b;
   z=sum(of top_m1-top_m&obj_num);
   %let min_str=;
   %let max_str=;
```

Fig. 4. Partial code

This section first analyzes the factors that affect the learning effectiveness of students in digital oral courses and provides reference for relevant research. A preliminary evaluation index system for oral digital course learning activities is established, and a reasonable expert screening mechanism is used to screen the indicators. A practical and feasible evaluation index system is established. Then, the comprehensive screening method is used to comprehensively evaluate the learning activities of students in online courses. The reasonable application of the evaluation system not only avoids the complex transformation of different quality data, but also comprehensively considers the process and results of learning activities, ensuring the objectivity and impartiality of the evaluation results.

5 Conclusion

This article describes the application methods of digital oral technology in clinical and teaching, summarizes the application strategies of digital oral technology in the field of oral restoration, and based on the technological advantages of digital oral technology, more scientific methods should be adopted for promotion in practice and teaching. The advantages of digital oral technology can be summarized as follows:

1) Improve the detailed display of dental anatomical morphology teaching models to make them more vivid and realistic;

2) Improve the clinical practicality of teaching dental anatomy and morphology. It is difficult to reveal individual differences in the anatomical morphology of oral teeth in clinical practice solely through traditional classroom lectures and standard dental models, which makes it easy for dental students to design or produce dental crown shapes that are detached from clinical practice during internships;

3) Enrich teaching resources and improve the teaching system.

Throughout this article, there are still shortcomings in the research process, which are also the research directions for future articles:

1) Lack of in-depth research. During the completion process of this article, we visited dental clinics, dental hospitals, and colleges that have established dental majors, but they were relatively concentrated, mainly in a fourth tier city in Hebei. There is a lack of detailed data on the application level of digital dental technology and equipment usage in first and second tier cities.

2) Due to the focus of this article on vocational education, there is a lack of understanding of undergraduate and graduate education in the field of dentistry. Dentistry is a popular major, especially with an explosive growth in the number of applicants in the past two years.

3) Establishing a detailed digital oral technology and professional education promotion system, assisting in professional development, this article needs further in-depth research in curriculum construction and curriculum system promotion.

References

[1] Z.-H. Liu, Accurate Implantation and Long-term Stability with the Assistance of Computer-aided Design, Journal of Oral Science Research 37(9)(2021) 775-779.

[2] J.-K. Yin, S.-F. He, R.-J. Xu, Comparison of clinical accuracy between digital dental implant impression and traditional dental implant impression, Qingdao Medical Journal 53(5)(2021) 345-347.

[3] Z.-T. Xu, W. You, H.-H. Zhang, D. Zhou, Preparation and performance optimization of addition cured silicone rubber used as dental impression material, New Chemical Materials 49(12)(2021) 250-252.

[4] J.-T. Zhang, Z.-W. Hu, Z.-B. Zhang, Comparative analysis between 3D printed dental casts and traditional plaster casts, Modern Manufacturing Engineering (10)(2017) 35-40.

[5] W.-J. Peng, Z.-H. Mao, C.-Y. Xu, H. Xiao, study on fitting method of dental arch line based on 3Dscanning dental model, Mechanical Engineering & Automation (4)(2023) 16-17+20.

[6] J.-T. Zhang, Z.-W. Hu, Z.-B. Zhang, Comparative analysis between 3D printed dental casts and traditional plaster casts, Modern Manufacturing Engineering (10)(2017) 35-40.

[7] D. Ma, D.-Q. Zhang, W.-B. Zhang, X. Li, Reconstruction of Human Model 3D Model Based on Reverse Engineering Technology, Machinery Design & Manufacture (2)(2017) 91-93.

[8] H.K. Jang, S. Kim, J.S. Shim, K.W. Lee, H.S. Moon, Accuracy of impressions for internal-connection implant prostheses with various divergent angles, The International journal of oral & maxillofacial implants 26(5)(2011) 1011-1015.

[9] S.-H. Jo, K. Kim, J.-M. Seo, K.-Y. Song, J.-M. Park, S.-G. Ahn, Effect of impression coping and implant angulation on the accuracy of implant impressions: an in vitro study, The Journal of Advanced Prosthodontics 2(4)(2010) 128-133.
[10] M. Alikhasi, H. Siadat, A. Nasirpour, M. Hasanzade, A.M. Vitalariu, Three-Dimensional Accuracy of Digital Impression versus Conventional Method: Effect of Implant Angulation and Connection Type, International Journal of Dentistry 2018(Pt.l)(2018).
[11] X.-B. Xu, Y.-L. Gong, Y.-Y. Wu, N. Xu, M. Wang, Application of intraoral scanning digital impression technology in full crown restoration of subgingival defect in molar area, Journal of Clinical Stomatology 39(1)(2023) 11-14.
[12] X.-D. Chen, J.-F. Chen, Research Progress in Clinical Application of Digital Oral Scanning System, Journal of Oral Science Research 36(7)(2020) 611-615.
[13] H.-B. Sun, B.-D. Zhao, D.-S. Wang, F.-Z. Liu, F. Zhong, The video of Magnified Video Camera System in Oral Maxillofacial Surgery Clinic Trainee Teaching, Medicine Teaching in University (Electronic Edition) 5(2)(2015) 25-28.
[14] J. Li, L. Huang, F. Wang, Y. Dong, Study on the application and effectiveness of video feedback teaching methods in practical teaching of tooth preparation for prosthodontics, Chinese Journal of Practical Stomatology 17(1)(2024) 80-84.
[15] J.-W. Guo, Y. Lu, Y.-C. Yao, Y. Wang, Application of three-dimensional digital model in clinical teaching of prosthodontics, Chinese Journal of Practical Stomatology 17(1)(2024) 85-89.
[16] T.-H. Tang, C.-Y. Zhu, W.-M. Wong, Accuracy research of digital impression technology applied in dental implant restoration, Chinese Journal of Prosthodontics 25(2)(2024) 97-102.
[17] Z. Zhang, Z.-Y. Ding, J.-F. Li, N. Cui, L. Ding, G.-F. Jiang, Comprehensive Evaluation of DRGs Performance in Clinical Departments Based on Entropy Weight-TOPSIS-RSR Joint Method, Chinese Health Quality Management 30(7)(2023) 38-42.