

## Application Research of 3D Digital Model in Orthodontic Experiment Teaching

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**Abstract.** To study the influence of digital model measurement compared with traditional model measurement on orthodontics experimental teaching. A total of 50 undergraduate students in the College of Stomatology, Hebei Medical University were randomly divided into two groups. One group used traditional models measurement for teaching, and the other group used digital models and software for model measurement. Compare the influence of traditional group and digital group teaching on students' teaching effect and teaching efficiency, and then test the consistency of their measurement. Questionnaires are used to survey students' scores on traditional and digital teaching methods, as well as evaluations of different teaching methods. Using the independent sample T test and the kappa consistency test, statistical analysis showed that students using the digital model measurement group were faster, had more accurate results, and felt easier to operate after the experience. The data consistency was superior to the traditional model measurement group. These results are statistically significant; both methods of measurement contribute to the understanding of theoretical concepts and improve students' interest in learning, and the results are not statistically different. Digital model measurement improves the effectiveness and efficiency of orthodontic experiment teaching, enriches the teaching mode of experimental teaching, and is an important supplement to the study of orthodontic theory.

In recent years, the combination of digital technology and the traditional dental industry has brought great changes to stomatology. The digital dental data can be applied to prosthodontics, orthodontics, oral implant, etc.<sup>[1]</sup>. Nowadays, the situation on the experimental teaching of orthodontics has rapidly increased the number of students, and the class time is relatively tight. In order to ensure the effective realization of teaching objectives in a limited time, in the context of digitalization, experimental teaching combined with the characteristics of the course itself do reform.

**1. Experimental Material:** orthodontics experiment ——oral examination and diagnosis: model measurement

**2. Experimental Procedure:** The students were randomly divided into traditional teaching group and digital teaching group, 25 persons of each group, using two teaching methods to carry out experimental teaching, including the measurement of the three-dimensional direction of the model: the measurement of sagittal upward crowding; measurement of vertical to spee curvature; measurement of horizontal arch width and base bone width. After then make the questionnaire test, including objective indicators (measurement time and measurement accuracy, consistency) and

subjective indicators (concept understanding, operational difficulty, participation interest). Take the statistical analysis of the questionnaire data, comparative digital model measurement with traditional models measurement on teaching effect and teaching efficiency, and checkout whether the digital model measurement can improve the learning quality of undergraduate students.

The experimental group applied 3shape scanner to scan the digital model and measured it under the 3shape Ortho analyzer interface. After 6 minutes of standard teaching, the students measured and recorded the experimental results. The traditional teaching group applied the same plaster model, using brass wire and vernier caliper. The measurement is carried out by students after 10 minutes of standard teaching, the student recorded the results of the experiment.

### 3. Results

Teaching evaluation of **Tab-1** digital group and traditional group

index	Measurement time (min)	Measurement accuracy	concept understanding	Easy to operate	participate interest
Digital group	13*	95%*	1.5	1.2*	5
Traditional group	40	78%	2.8	4.3	3.3

\*The analysis is statistically significant

The concept understands 1-5 points, the understanding is very simple 1 point, the understanding is more difficult 5 points;

Operation is difficult 1-5 points, the operation is very simple 1 point, the operation is more difficult 5 points;

Participate in 1-5 points of interest, 1 point lower interest, 5 points higher in interest;

**Tab-2** Digitization Group & Traditional Teaching Group Measurement Consistency Test

index	Congestion	Spee curvature	Arch width	Base bone width
Digital Group & Traditional Teaching Group (Kappa Value)	0.198	0.532	0.788	0.593

### 4. Discussion

The combination of 3D printing technology and digital oral technology has spawned a series of dental digital products, including 3D printed restorations on the chair of the prosthetics department, digital guides for planting, virtual surgical simulation of the orthognathic, orthodontic bracketless invisible correction techniques, etc, not only improve the accuracy of diagnosis and treatment, but also make full use of 3D digitization technology in the treatment process to achieve visual, predictable and controllable purposes, and make stomatology enter a new stage<sup>[2]</sup>.

The object of orthodontics research is the development, angle and relationship of the three-dimensional structures of the human body, cranial, jaw and face. The original two-dimensional measurement method lack of accuracy<sup>[3]</sup> in the positioning and measurement leads to difficulties in the understanding process due to problems such as enlargement, overlap and deformation. so traditional two-dimensional examinations can no longer meet the requirements of modern orthodontic teaching. With the wide application of digitalization, we also actively combine digital technology with orthodontic teaching, optimize teaching design, improve teaching effect,

and improve teaching efficiency. Therefore, in the experimental teaching of model measurement, we tentatively applied the three-dimensional digital model for teaching reform.

There are two main methods for making digital impressions<sup>[4]</sup>: the digital technology of the model and the direct scanning technique in the mouth. The former is a digital model for scanning the dental model that is currently mature which meets the clinical accuracy requirements and is already in clinical application. The latter technique is to replace the imprinting of the impression, and obtain the color three-dimensional information of the teeth and gums directly in the mouth. The clinical application of digital technology has greatly helped physicians to make more comprehensive and accurate diagnosis of patients. In this experiment, we selected the digital model generated by the first method for measurement analysis.

The experimental results show that: in the objective indicators, the measurement time using the digital group is much faster than the traditional group, which is statistically significant, and which helps students to concentrate on time to understand and learn more content in a limited teaching time; as for accurate rate of measurement, the digital group also has an absolute advantage, which can guide the clinical application of digital models in diagnostic analysis. In the consistency test, the kappa value of congestion measurement is less than 0.2, and there are significant differences between the two groups, suggesting that traditional measurements has more variability by larger individual factors than that of the digital group, suggesting that in the future research, the application of digital technology in model measurement can improve accuracy and reduce variability. In the term of the subjective indicators, the application of the two methods is relatively easy to understand the concept of model measurement. As a supplement to the theory learning, it has the same support effect; in the specific operation, the students think that the digital operation is easier, which may be due to the software. Because the function of the plate is clearer, and the calculation is more accurate, but the manual measurement is more likely to be caused by errors. For the enthusiasm of participation, the two experimental methods also gain the interest of the students. Therefore, to prove the content of the theory in the experimental class is an important component that is indispensable in undergraduate orthodontics learning, requiring constant optimization of the organic combination of experiment and theory, giving students a better quality curriculum design and a better curriculum experience.

The three-dimensional digital technology has the advantages of high precision, true reflection of three-dimensional shape, high efficiency and convenience, visualization and operability. The huge revolution of digital technology and computer technology will inevitably bring about a change in the mode of medical teaching. Students fell more affinity and challenge<sup>[5]</sup>. Due to the compression of teaching time for undergraduate, the content is numerous, which puts forward higher requirements for students' self-learning ability and the teaching ability of lecturers. At the same time, we hope to deepen students' understanding of knowledge in a limited time. Therefore, we hope to develop and apply more digital software, and apply 3D digital technology to the teaching of orthodontics<sup>[6]</sup> to explore whether it can help teachers and students solve many problems in teaching.

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