

Exploration and Practice of Comprehensive Clinical Rotation Internship for Undergraduate Dental Students: A New Internship for Undergraduate Dental Students

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Abstract

Background: University-based programs should aim to teach dental students about practice procedures to gain insight into day-to-day activities.

Objective: This study introduces a newly established comprehensive dental professional curriculum, including an additional 9-week comprehensive rotation internship program

Methods: All dental students from the Department of General Dentistry II under Peking University School and Hospital of Stomatology (PKUSS) who completed a specialized internship in the five research areas (endodontics, periodontics, prosthodontics, oral and maxillofacial surgery, and pediatric dentistry), including an additional 9-week comprehensive rotation, were invited to participate in the survey (total n = 253 in years 2017–2019).

Results: A total of 70.4% of students believed that a 9-week comprehensive rotation was necessary to improve the program, 76.8% thought it was essential to introduce dental comprehensive specialization, 75.6% felt that the dental comprehensive specialty internship should last longer, and 83.2% believed that the dental comprehensive specialty internship helped them develop comprehensive diagnostic and treatment thinking abilities.

Conclusions: The comprehensive rotation model was effective in helping students establish comprehensive diagnostic thinking and train multi-specialty clinical skills. Further exploration and improvement are needed to effectively leverage the advantages of multi-specialty training in the comprehensive teaching clinic.

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Original Manuscript

Exploration and Practice of Comprehensive Clinical Rotation Internship for Undergraduate Dental Students

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Abstract

Background: University-based programs should aim to teach dental students about practice procedures to gain insight into day-to-day activities. This study introduces a newly established comprehensive dental professional curriculum, including an additional 9-week comprehensive rotation internship program.

Methods: All dental students from the Department of General Dentistry II under Peking University School and Hospital of Stomatology (PKUSS) who completed a specialized internship in the five research areas (endodontics, periodontics, prosthodontics, oral and maxillofacial surgery, and pediatric dentistry), including an additional 9-week comprehensive rotation, were invited to participate in the survey (total n = 253 in years 2017–2019).

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Conclusion: The comprehensive rotation model was effective in helping students establish comprehensive diagnostic thinking and train multi-specialty clinical skills. Further exploration and improvement are needed to effectively leverage the advantages of multi-specialty training in the comprehensive teaching clinic.

Keywords: Stomatology, undergraduate, clinical internship, comprehensive diagnosis and treatment thinking training

Introduction

Clinical internships are crucial to dental education, combining medical theoretical learning with clinical practice. One of the primary benefits of internships is gaining hands-on experience in a real-world setting. It is important not only as a link to dental education but also as an approach that significantly enhances the ability of dental students to engage in practical work and reach professional quality.

Department of General Dentistry II under Peking University School and Hospital of Stomatology (PKUSS) was established in 2008. As a teaching base, it has undertaken the task of clinical rotation internships for fifth-year students in the five-year and eight-year dental programs for 16 consecutive classes. Establishing a comprehensive clinic enhances the overall teaching cohesion, allowing patients to receive comprehensive treatment within the department. However, current clinical teachings mainly follow a specialized rotation model based on the standardized training of fundamental theories and skills. However, overall understanding and comprehensive analytical abilities of oral diseases among medical students remain relatively weak due to a lack of training in this area.

The cultivation of comprehensive diagnostic and treatment thinking in dentistry primarily focuses on the clinical direction of general dentistry, emphasizing patient-centered care, providing comprehensive, continuous prevention and treatment services for common oral diseases, and maintaining oral health. Over the years, the dental clinical internship model in China has introduced new opportunities and challenges for dental professionals aiming to improve their comprehensive diagnostic and treatment thinking. Globally, the primary training model for clinical internships of medical students is based on comprehensive diagnosis and treatment [1]. Both domestic and international institutions have explored comprehensive internship models [2, 3]. However, no unified model or standard exists for standardized comprehensive internship training. Different schools have varying practices regarding internship bases, faculty, content, and arrangements. Thus, exploring and establishing a training system for comprehensive dental diagnosis and treatment professionals is necessary.

As one of the early-established comprehensive teaching clinics in China, the Department of General Dentistry II under PKUSS has undertaken significant clinical internship teaching,

accumulating rich teaching experience. This study introduced a newly established comprehensive dental professional curriculum, which includes an additional 9-week comprehensive rotation internship program. An anonymous questionnaire survey was conducted among students after the internship to explore the comprehensive internship teaching model, thus laying the foundation for establishing comprehensive diagnostic thinking and teaching models in dentistry.

Materials and methods

Comprehensive Rotational Internships

Teaching Arrangement for Comprehensive Rotational Internships

After completing specialized internships in Endodontics, Periodontics, Prosthodontics, Oral and Maxillofacial Surgery, and Pediatric Dentistry, students gained essential knowledge and skills in diagnosing and treating prevalent diseases. Subsequently, they underwent a 9-week comprehensive rotational phase, which included an internship in the newly established Dental Comprehensive Specialty, where they were given the opportunity to provide comprehensive care, including thorough oral examinations, comprehensive treatment planning, multi-disciplinary dental treatments, and overall oral health management. During this time, students continued their internship programs in the six specialties, with each specialty taught by dedicated instructors. A high-ranking general dentistry instructor was overseeing the teaching. The instructors for each specialty were consistent, and students rotated between specialties, which allowed them to receive multi-disciplinary treatment within the same clinic.

Preparations Before Comprehensive Rotational Internships

From 2011 to 2018, PKUSS cooperated with the Eastman Institute for Oral Health at the University of Rochester, USA, to train internationally qualified general dentistry educators. The teaching clinic has four faculty members certified by the Advanced Education in General Dentistry (AEGD) program, acting as key general dentistry educators. Since 2012, twelve faculty members have earned medium professional titles. In 2014, the clinic launched its "comprehensive registration", emphasizing one-stop service for patients.

Before the comprehensive rotational internship, a faculty mobilization meeting was held to clarify the teaching objectives and to outline the teaching content. The rotational internship aimed to

help students develop comprehensive diagnostic thinking and clinical skills. The pre-clinical teaching content included theoretical courses on comprehensive diagnostic thinking and training, studies on collecting and organizing comprehensive cases and nationally awarded exemplary comprehensive cases as demonstrations. The clinic's comprehensive teaching case database was also available for clinical teaching to ensure smooth teaching operations.

Content Arrangement for Comprehensive Rotational Internships

The core of the comprehensive rotational internship is grounded in fundamental knowledge and skills, emphasizing the standardization of basic operations and the development of comprehensive diagnostic thinking. It also includes strict requirements for process organization and teaching methods. The internship lasts nine consecutive weeks, totaling 315 hours (4.5 days per week are dedicated to clinical practice and 0.5 days to advanced clinical problem-solving courses, including interdisciplinary and humanistic theory courses).

The teaching clinic offers internships across the six specialties: Endodontics, Periodontics, Prosthodontics, Oral Surgery, Pediatric Dentistry, and Dental Comprehensive Specialty. The teacher-to-student ratio is 1:4–1:5, with one teacher supervising 4–5 students. Various teaching formats include daily summaries, mini-lectures, literature reviews, case presentations, clinical demonstrations, end-of-course assessments, and case displays. Teachers are responsible for monitoring every stage of the patient reception process, ensuring thorough oversight at each step. Typical cases are demonstrated using microscopes, surgical demonstrations, and digital restoration demonstrations. Additionally, medical ethics, patient communication, and other humanistic concepts are integrated throughout the teaching process, fostering a learning environment focused on ethical and professional development.

The teaching model of the dental comprehensive specialty internship is shown in **Figure 1**. During dental comprehensive specialty internship, the new patients are comprehensively examined. Then, under the guidance of instructors, dental students formulate comprehensive treatment plans and provide multi-disciplinary care, documenting the comprehensive medical records according to standard protocols. Faculties oversee each critical step. After daily internships, discussions and summaries are held, where instructors and students analyze and summarize clinical issues encountered during the day, review foundational knowledge, reflect on problems in the diagnostic process, and identify common issues and areas for improvement in techniques, procedures, and patient communication. The instructors organize multi-disciplinary case discussions for complex

cases to establish and cultivate comprehensive dental thinking and clinical skills among students.

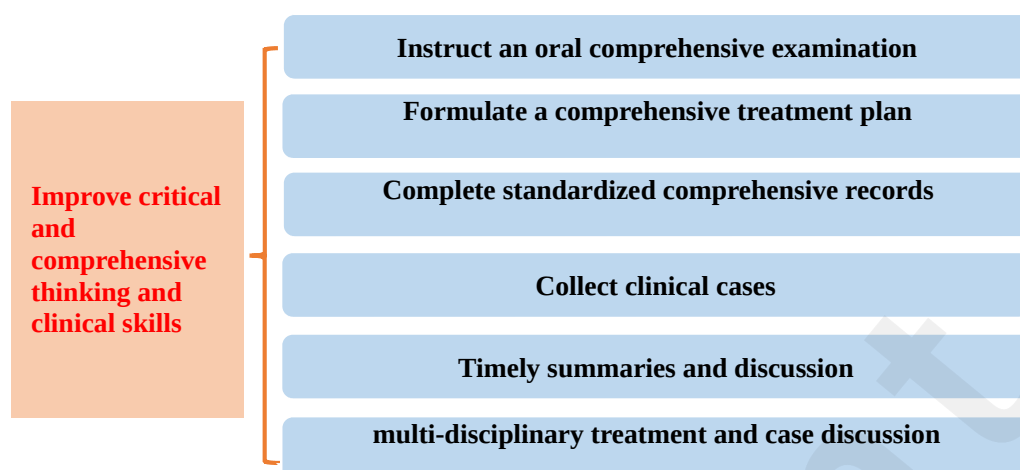


Figure 1. Teaching model of dental comprehensive specialty internship.

Questionnaire Survey

The questionnaire for this study was designed based on two aspects: the arrangement of comprehensive rotations and the internship in Dental Comprehensive Specialty, with four items under each aspect, evaluated with Very Satisfied, Satisfied, Neutral, Somewhat Unsatisfied, and Very Unsatisfied. Besides basic demographic information, the questions regarding the comprehensive rotation arrangement included four items: the necessity of the 9-week comprehensive rotation, its duration, self-assessment of clinical ability improvement, and the impact on clinical skills development in each specialty. Regarding the internship in Dental Comprehensive Specialty, the four items focused on the need for rotational training, the duration of the training, the influence on developing comprehensive diagnostic thinking, and the impact on self-assessed clinical ability improvement.

A total of 253 dental students, 101 males and 152 females (85 students from the class of 2017, 80 students from the class of 2018, and 88 students from the class of 2019) from the Department of General Dentistry II under PKUSS who were from 8-year program and 5-year program were invited. All participants were informed and consented to participate in the study. The questionnaire was administered at the end of the internship using electronic survey links sent via WeChat. Instructions were provided uniformly, and the respondents anonymously filled out the survey.

Statistical Analysis

SPSS ver. 20.0 software (SPSS, Inc, Chicago, IL, USA) was used for all the statistical analyses.

Descriptive statistical methods were used to analyze the proportion of different options for each item, and the K-W test was employed to evaluate the differences between the proportions of different options. A two-sided test was used, and a P-value of <0.05 was considered statistically significant.

For the statistical analysis, the responses were grouped as follows: "Very Necessary" and "Somewhat Necessary" were combined as Necessary, "Neutral" was treated as Neutral (not included in the statistics), and "Somewhat Unnecessary" and "Very Unnecessary" were combined as Unnecessary. Similarly, "Very Satisfied" and "Somewhat Satisfied" were combined as Satisfied, and "Somewhat Unsatisfied" and "Very Unsatisfied" were combined as Unsatisfied. "Much improved" and "Somewhat improved" were combined as Improved; "Somewhat Reduced" and "Much Reduced" were combined as Reduced.

Results

A total of 250 dental students completed the survey questionnaires altogether, for an overall response rate of 98.8% ($n=250/253$), including male 39.6% ($n=99/250$) and female 60.4% ($n=151/250$), respectively. Among these, 70.4% believed adding a 9-week comprehensive rotation was necessary, while 11.2% thought it unnecessary (**Figure 2a**). Moreover, 46.4% of the students believed increasing the duration of the comprehensive rotation internship was necessary, while 14.4% disagreed (**Figure 2b**). In addition, 65.6% of the students felt their clinical skills improved after the internship was completed, while 4.4% felt their clinical skills had not improved (**Figure 2c, Table 1**). Also, 76.8%, 80.8%, and 70.0% of the students believed that their critical thinking and clinical skills in diagnosis and treating disease in periodontics, endodontics, and oral surgery, respectively, were further improved through the comprehensive rotation (**Figure 3, Table 2**).

(B)

(C)

Figure 2. Evaluation of the necessity, duration, and improvement in clinical competence of the 9-week rotation internship program (*p<0.05). (A) The necessity of adding a 9-week program. (B) The necessity of increasing the duration of the 9-week program. (C) Evaluation of satisfaction with improvement in clinical competence.

Table 1. Descriptive distribution of necessity, duration, and overall effect evaluation of 9-week comprehensive rotation

		Frequency	Percentage
Necessity	Very Necessary	70	28.0%
	Somewhat Necessary	106	42.4%
	Neutral	46	18.4%
	Somewhat Unnecessary	18	7.2%
	Very Unnecessary	10	4.0%
Increased duration	Very Necessary	52	20.8%
	Somewhat Necessary	64	25.6%
	Neutral	98	39.2%
	Somewhat Unnecessary	23	9.2%
	Very Unnecessary	13	5.2%
Clinical competence	Very Satisfied	36	14.4%
	Somewhat Satisfied	128	51.2%
	Neutral	75	30.0%
	Somewhat Unsatisfied	9	3.6%
	Very Unsatisfied	2	0.8%
Total		250	100.0%

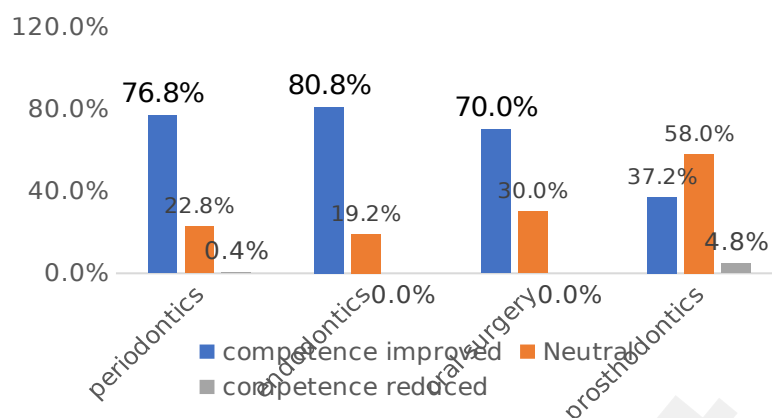


Figure 3. Effect of 9-week rotation program on improving clinical competence in each specialty.

* $p < 0.05$

Table 2. Cross-tabulation of the effect of a 9-week comprehensive rotation program on the improvement of clinical competence in each specialty

Specialty	Clinical Competence					Total
	Much Improved	Somewhat Improved	Unchanged	Somewhat reduced	Much reduced	
periodontics	80 32.0%	112 44.8%	57 22.8%	1 0.4%	0 0.0%	250
endodontics	88 35.2%	114 45.6%	48 19.2%	0 0.0%	0 0.0%	250
oral surgery	79 31.6%	96 38.4%	75 30.0%	0 0.0%	0 0.0%	250
prosthodontics	33 13.2%	60 24.0%	145 58.0%	10 4.0%	2 0.8%	250
	166	260	219	14	1	

Evaluation results for Dental Comprehensive Specialty are shown in **Figure 4** and **Table 3**. A total of 76.8% of the students believed that it was necessary to add Dental Comprehensive Specialty, while 7.6% thought it was unnecessary (**Figure 4a**). In addition, 75.6% of the students believed it was necessary to increase the internship duration, while 8.0% thought it was unnecessary (**Figure 4b**). Also, 60.8% of the students were satisfied with the improvements in clinical skills from the comprehensive specialty, while 5.2% were unsatisfied (**Figure 4c**). Moreover, 83.2% of the students believed the Dental Comprehensive Specialty internship helped them develop comprehensive diagnostic and treatment thinking, while 16.8% thought it did not (**Figure 4d**).

(A)

(B)

(C)

(D)

Figure 4. Evaluation of the necessity, duration, and improvement of clinical competence and comprehensive thinking from Dental Comprehensive Specialty. (A) The necessity of adding Dental Comprehensive Specialty to the program. **(B)** The necessity of increasing the duration of Dental Comprehensive Specialty. **(C)** Evaluation of satisfaction with improvement on dental comprehensive competence. **(D)** Evaluation of improvement on comprehensive diagnostic and treatment thinking. * $p < 0.05$

Table 3. Descriptive distribution of necessity, duration, and effect evaluation of dental comprehensive specialty internship

		Frequency	Percentage
Necessity	Very Necessary	95	38.0%
	Somewhat Necessary	97	38.8%
	Neutral	39	15.6%
	Somewhat Unnecessary	16	6.4%
	Very Unnecessary	3	1.2%
Lengthen duration	Very Necessary	95	38.0%
	Somewhat Necessary	94	37.6%
	Neutral	41	16.4%
	Somewhat Unnecessary	11	4.4%
	Very Unnecessary	9	3.6%
Clinical Competence	Very Satisfied	52	20.8%
	Somewhat Satisfied	100	40.0%
	Neutral	85	34.0%

comprehensive diagnostic and treatment thinking	Somewhat Unsatisfied	11	4.4%
	Very Unsatisfied	2	0.8%
	Very Helpful	90	36.0%
	Somewhat Helpful	118	47.2%
	Neutral	40	16.0%
	Somewhat Unhelpful	2	0.8%
	Very Unhelpful	0	0.0%
Total		250	100.0%

Discussion

Clinical internships are foundational to professional training, allowing medical students to integrate basic theory, essential knowledge, and fundamental skills through clinical practice. It is a transitional zone through which newly qualified physicians are integrated into team-based care. Department of General Dentistry II at PKUSS, as a teaching base, pioneered the establishment of a comprehensive teaching clinic in China. This setup allows students to undertake specialty internships in different areas of the comprehensive clinic. During the specialty internship phase, students are guided by specialized doctors who standardize and refine their clinical operational skills. Simultaneously, the open nature of the comprehensive clinic strengthens inter-specialty connections, facilitates multi-specialty consultations and referrals for patients, enhances the overall coherence of the teaching process, and aids in completing comprehensive treatments within the department. This setup also helps students observe and understand complex, comprehensive cases, which to some extent promotes the development of students' clinical comprehensive diagnostic thinking [4]. Several other domestic institutions have been exploring and practicing the comprehensive clinic teaching model in China. Ping *et al.* [5] and Hui *et al.* [6] have confirmed that compared to traditional departmental internships, students following the specialty teaching model within the comprehensive clinic can better consolidate theoretical knowledge and cultivate their clinical thinking abilities, thereby benefiting the enhancement of comprehensive analytical skills. However, even within a comprehensive clinic, this specialized training approach often lacks systematic training in comprehensive diagnostic concepts, making it challenging for students to integrate knowledge from various specialties. As a result, they may find it difficult to propose the most reasonable comprehensive treatment plans for patients with complex oral conditions, hindering the students' abilities to comprehensively analyze and solve problems [7].

Herein, we proposed a comprehensive rotational program after students have mastered the basic diagnostic knowledge and fundamental operational skills of various specialties to address this issue. This model enhanced students' abilities to analyze and solve problems comprehensively and to establish a holistic generalist perspective. During the comprehensive rotational program, students alternate their internships across six specialties (Periodontics, Endodontics, Prosthodontics, Oral Surgery, Pediatric Dentistry, and Comprehensive Dentistry), with patients following the medical students for rotational treatment. In particular, the Comprehensive Dentistry specialty emphasizes thorough oral examinations and phased comprehensive treatment planning, aiming to help students develop comprehensive diagnostic thinking. This approach seeks to improve students' comprehensive diagnostic and treatment capabilities while ensuring specialized and meticulous training in each specialty, thereby enhancing the effectiveness of the internship teaching.

Currently, the teaching model for clinical internships of dental students both domestically and internationally tends towards centralized teaching in comprehensive clinics [5-12]. However, most comprehensive treatment models in China are similar to our previous teaching model, based on specialized rotations within a physical comprehensive clinic. This approach involves specialized instructors guiding the teaching process, with little emphasis on a comprehensive faculty implementing a generalist diagnostic and treatment philosophy. Even though the specialized rotation model within comprehensive clinics has been shown in numerous studies to have certain advantages, theoretical exam scores [5, 6] and practical skills [6, 9] of these students are generally higher than those who underwent rotations in specialized departments. Also, patients can complete (or almost complete) comprehensive dental treatment within one department, increasing their trust in the doctors and the department. However, specialized instructors tend to focus on their areas of expertise during teaching, often resulting in patients receiving multi-specialty treatment within the department without a comprehensive, coordinated, patient-tracking approach that offers the most reasonable overall diagnostic and treatment plan. Students also miss out on learning about the entire treatment process for patients [10].

Gong *et al.* [13] attempted to strengthen comprehensive training programs in integrated teaching, focusing on developing students' abilities to analyze cases from multiple specialties and perspectives, formulate comprehensive treatment plans tailored to each patient, and follow the entire treatment process, which aligns with our proposed concept of integrated teaching. They found that, compared to the specialized group, students in the comprehensive group showed no significant advantage in professional skills but demonstrated significantly better case analysis abilities.

However, in this study, students began comprehensive rotations without prior exposure to clinical reception and actual operations in various specialties, leading to a significant amount of time being spent familiarizing themselves with these aspects, thus reducing the time available for comprehensive training [13]. The specific qualifications of the teaching faculty were also not mentioned. The availability of internship opportunities and high-quality teaching faculty represent significant concerns for medical students [14, 15].

In Wu's study, the one-stage group reported longer independent operation time than the three-stage. Their confidence level related to comprehensive skills, such as arranging appointments and managing patients and procedures needing long treatment periods, such as molar endodontics, was higher. The three-stage group showed higher confidence in more specialized surgical extractions and suturing [16]. Praveen *et al.* [17] found that students under the comprehensive teaching model reported higher self-confidence in 22 clinical operations, including history recording, clinical examination, diagnosis, emergency management, and basic simple procedures like anterior teeth endodontics and subgingival scaling. The faculty in these studies were still specialized professionals. In our study, medical students reported improved abilities in restorative and endodontic, periodontal, and surgical specialties, feeling more confident throughout the diagnostic and treatment process, which could be due to their solid foundation in specialized clinical skills gained from prior specialized training. This background made students more adept at clinical reception skills and treatment operations during the comprehensive rotation. As internship practice opportunities and time accumulate, clinical skills will further improve, allowing more focus on developing a holistic, generalist approach and comprehensive analysis of complex cases.

In our study, the majority (83.2%) of medical students felt that the comprehensive internship strengthened their ability to comprehensively analyze cases, giving them more confidence in handling complex cases, which is consistent with findings by Hattar et al. and Dehghan et al. Hattar noted that the comprehensive teaching model allowed them to effectively address patients' needs and provide higher satisfaction. Furthermore, it positively influenced self-confidence, permitted greater exposure to clinical techniques and enhanced reasoning and analytical skills [11]. Students in Dehghan's study [18] accomplished more comprehensive dentistry with greater consistency of supervision from faculty in a more patient-centered environment than in the departmental model. However, Dehghan recommended rotating group leaders at least every six months. In our study, the additional comprehensive rotation and dental comprehensive specialty internship lasted only nine weeks due to time constraints. Most students desired to extend the duration, indicating high

enthusiasm for the internship and confirming the success of adding the comprehensive internship. We also ensured that students received guidance from two general dental educators (one senior and one experienced medium-ranking dentist) to avoid a sole teaching perspective and optimize the learning experience.

Globally, in developed regions of dental medicine, the clinical workforce consists predominantly of general dentists (85%) with specialists (15%) in a "pyramid" structure [15]. Training for medical students should align with societal needs, prioritizing the education of competent general dentists as the mainstay of dental healthcare. Clinical internships for undergraduate medical students form the foundation of the entire dental education system. Most undergraduate students engage in general practice after graduation, making it socially significant to instill generalist thinking and enhance their comprehensive case analysis abilities early in their internship training.

Conclusion

This new comprehensive rotational internship program can improve diagnostic thinking and enhance their multi-specialty clinical skills in dentistry. However, further exploration and improvement are still required on the specific duration of the comprehensive rotation and the best way to integrate it with specialized rotations to maximize the potential benefits of comprehensive teaching clinics.

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- Authors' contributions

YL, NA, YJ, and WG conceptualized, designed, and supervised the research. WG and CF instructed the dental comprehensive specialty internship. NA designed the questionnaire, and YL carried out the data acquisition. YL and JH performed statistical analysis and

interpretation. YL and NA drafted the manuscript, and NA provided critical revisions. All authors listed have made substantial contributions and approved the final manuscript.

Conflicts of Interest

none declared

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