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Understanding the role of a general education course Oral Science in establishing oral health knowledge and behaviors among undergraduate students from different majors: a questionnaire-based study

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Abstract

Background The general education course, Oral Science, has been offered by Guanghua School of Stomatology, Sun Yat-sen University for many years in order to improve students' knowledge of oral health. Information about the oral health knowledge, status, and behaviors among undergraduates who had taken Oral Science was collected to evaluate the impact of this course, and to provide a basis for further improvement of the course teaching quality.

Methods Undergraduates taking Oral Science as an elective course were selected as the research subjects. The research time is the second semester of the 2022 academic year, from February 2023 to June 2023. Undergraduates who had not taken the course served as the control group. To investigate the oral health knowledge, status, and behaviors among undergraduate students who have taken the general education course of Oral Science, course students and non-course students were asked to fill out the same questionnaire at both the beginning and end of semester. The answer scores and accuracy of these two groups were compared and analyzed. Before and after the first lesson, and at the end of the semester, course students were asked to fill out the same oral knowledge questionnaire. Another questionnaire was released in week 10 to collect the data of the course students' oral health status and behaviors. The control group completed the same oral knowledge questionnaire at the beginning and end of the semester, respectively. SPSS 20.0 statistical software was used to analyze the data. Statistical significance level was set at 0.05 for all tests.

Results At the beginning of the semester, there was no significant difference in the accuracy of the 16 questions nor the scores between two groups ($P > 0.05$). After one semester of learning, the accuracy of the 16 questions answered by the course students at the end of the semester was significantly higher ($P < 0.05$), as well as the score of the course students.

Conclusion The general education course of Oral Science can significantly improve undergraduates' general knowledge of dentistry and effectively improve their oral hygiene behavior.

Keywords General education, General knowledge of dentistry, Oral hygiene behavior

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Background

With the development of the economy and society in China and the basic formation of a medical and health service system, the public's oral health demands have gradually increased. However, basic oral health care is not an identified need within China. According to the data obtained from the Fourth National Oral Health Epidemiological Survey [1], residents in China had serious caries and poor periodontal condition, the prevalence of caries was above 50% in all age groups, subjects without periodontal disease accounted for <50%. It can be seen that the oral health status of Chinese residents needs to be improved and oral health care is not taken seriously enough in China. Dental care and oral health are directly related to overall health. As the saying goes, "Illness comes from the mouth". To add to the financial burden, poor oral health care leads to an increased risk of chronic diseases, including diabetes, heart disease, and stroke [2]. What's more, according to the Surgeon General's Report on Oral Health, poor oral health can negatively affect the quality of life and impact diet, nutrition, sleep, psychological status, social interaction, school, and work [3]. It is of great practical significance to let more people understand the basic knowledge of dentistry, improve oral hygiene behavior, and promote the oral health of the general public [4–6], which is also the responsibility of dentists and teachers of stomatology. To this end, Guanghua School of Stomatology, Sun Yat-sen University has offered a general education course, Oral Science, for undergraduates of all grades majoring in art, science, engineering, management and medicine of Sun Yat-sen University for many years. The purpose of Oral Science is to popularize the knowledge of dentistry to undergraduates who are not majoring in stomatology, so that they can master the scope of stomatology, the names of common oral diseases, be familiar with the etiology, clinical manifestations and prevention of the most common oral diseases, understand the principles of diagnosis and treatment of the above diseases, and know the relationship between oral diseases and systemic diseases. Through the study of the clinical manifestations of common oral diseases, it is hoped that students will be able to identify such diseases in their daily lives. Students are encouraged to analyze and summarize their own most prominent risk factors, and scientifically prevent the occurrence of certain oral diseases. Teachers will consciously guide students to integrate knowledge and action, and apply what they have learned to daily life.

There are many teaching related articles of the stomatology major, but there are limited studies on the education of stomatology as a general education course. Few studies have focused on the oral hygiene and oral literacy of undergraduate students [7]. The general education

course of Oral Science has been offered for many years, but the improvement of students' knowledge of dentistry after studying this course has not been analyzed. What could students gain by taking this course? How does the knowledge of this course affect students' daily oral hygiene habits and oral health awareness? None of these have been understood. In this study, a questionnaire survey was conducted on undergraduates who took Oral Science in the second semester of the 2022 academic year. Questionnaires were released at the beginning, middle and end of the semester to understand students' level of oral health knowledge, oral hygiene habits and oral health status. The purpose of this study is to investigate the oral health knowledge, status, and behaviors among undergraduate students who have taken the general education course of Oral Science, to examine how well students improved their knowledge of dentistry after the course and consider potential implications for continuous improvement in subsequent teaching.

Methods

Ethical approval and consent to participate

Informed consent was obtained orally from all subjects by action. Ethical approval was obtained from the Medical Ethics Committee of the Hospital of Stomatology, Sun Yat-sen University (Institutional Review Board no. KQEC-2024-06-01). The committee waived the request for either hard copy or any electronic-based informed consent, since the response to these questionnaires involved no more than minimal risk.

Subjects of the study

Students can select general education courses for each semester through the university's online course selection system. Undergraduate students who took Oral Science in the second semester of the 2022 academic year of Sun Yat-sen University were selected as the research subjects (hereinafter referred to as course students). Undergraduate students who had not taken Oral Science and filled out the questionnaire at the beginning and end of the semester respectively were served as the control group (hereinafter referred to as non-course students).

Questionnaire survey

To investigate the oral health knowledge, status, and behaviors among undergraduate students who have taken the general education course of Oral Science, course students and non-course students were asked to fill out the same questionnaire at both the beginning and end of semester. The answer scores and accuracy of these two groups were compared and analyzed. The questionnaires used in the study were developed for this study and have not previously been published elsewhere. The Oral

Health Knowledge Questionnaire (OHKQ) was delivered to the course students via WJX.cn before the first class, after the first class and at the end of the semester. WJX.cn is a professional online survey, examination, evaluation, and voting platform that provides personalized services such as designing questionnaires, collecting data, customizing reports, and analyzing survey results. It has the advantages of being fast, easy to use, and low-cost. The OHKQ included eight single-choice items and eight true/false items (the complete OHKQ, including pictures, is shown in Supplemental Fig. 1):

- What is the problem with the tooth indicated by the arrow in Figure A?
 - A. Tooth decay B. Discoloration of tooth C. Pulp exposure D. Tetracycline teeth E. Bleeding from the tooth
- What is the reason for the place pointed by the arrow in Figure B?
 - A. Biting hard objects B. Tooth decay C. Trauma D. Brush teeth horizontally E. Gum recession
- What is the problem with the tooth indicated by the arrow in Figure C?
 - A. Tooth decay B. Discoloration of tooth C. Developmental malformations D. Pulpitis E. Dental trauma
- How to effectively prevent the problem pointed by the arrow in Figure C?
 - A. Brush teeth in the morning and evening B. Rinse the mouth after a meal C. Use dental floss every day D. Don't eat sugar E. Use whitening toothpaste
- What is the problem with the tooth indicated by the arrow in Figure D?
 - A. Tooth structure B. Food scraps C. Calculus D. Pus E. Toothpaste remnants
- What is the most likely reason for frequent gum bleeding when brushing teeth?
 - A. Suffer from excessive internal heat B. Gingivitis C. Brushing teeth too hard D. Oral ulcer E. Oral tumor
- Bleeding gums often occur when brushing your teeth, what's the right thing to do?
 - A. Take anti-inflammatory drugs B. Drinking herbal tea C. Using hemostatic toothpaste D. Scaling teeth E. Dental filling

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- What are the following factors that are prone to inducing oral cancer?
 - A. Eating a large amount of sugar B. Chewing betel nuts C. Consumption of alcoholic beverages D. Prolonged exposure to the sun E. Smoking
- Teeth need to be exercised by biting on hard objects occasionally to strengthen them. Is this statement correct?
 - A. Yes B. No
- Frequent flossing can increase the gap between teeth. Is this statement correct?
 - A. Yes B. No
- Scaling causes the teeth to slowly become loose. Is this statement correct?
 - A. Yes B. No
- Scaling can enlarge the gap between teeth. Is this statement correct?
 - A. Yes B. No
- Scaling your teeth once a year is good for maintaining your oral health. Is this statement correct?
 - A. Yes B. No
- If the tooth is not painful, it means that there is no problem with the tooth. Is this statement correct?
 - A. Yes B. No
- Brushing teeth in the morning and evening, and tooth decay won't happen. Is this statement correct?
 - A. Yes B. No
- Losing teeth is a natural consequence of aging. Is this statement correct?
 - A. Yes B. No

In addition, another questionnaire was released in the middle of the semester to collect the data of the course students' oral health status and behaviors, including four questions: 1) What dental problems do you have? 2) Do you have regular oral examinations before taking the course Oral Science? If so, how often? 3) If the total score is 10, please rate your current oral health status; 4) After taking this course, do you have any plans for an oral examination this semester?

The QR code of the questionnaire was displayed to students during the class, and the teacher explained the intention and purpose of the questionnaire. Course students voluntarily scanned the code to answer the questionnaire.

The non-course students only completed the OHKQ at the beginning and end of the semester. The QR code was only released in the university east campus where the course was not offered. The QR code was forwarded to the WeChat class group by the student counselor, and the intention and purpose of the questionnaire was informed. Students participated in the questionnaire survey voluntarily. The questionnaires were collected, and unqualified questionnaires were eliminated (Students who only filled

out the questionnaire once were not included in the non-course students group, and the relevant data would not be analyzed). The research method flowchart is shown in Supplemental Fig. 2.

Statistical analysis

SPSS 20.0 statistical software (IBM Corp, Armonk, NY, USA) was used to analyze the data. The chi-square test was used to analyze the correct percentage of 16 questions at the beginning and end of the semester between the two groups. The scores of the two groups at the beginning and end of the semester were analyzed by rank-sum test analysis. The scores of the three OHKQs (before the first class, after the first class and at the end of the semester) of the course students were analyzed by the paired t-test or the paired rank sum test. Paired-rank sum test was used to determine statistical significance between the scores of the two OHKQs (at the beginning and end of the semester) of the non-course students. Statistical significance level was set at 0.05 for all tests.

Results

A total of 100 undergraduate students took Oral Science in the second semester of the 2022 academic year, and the number of course students who completed the OHKQ at all three time points is 92 (8 students only filled out one or two questionnaires, so the data was excluded). Another questionnaire was released in the middle of the semester and 89 valid questionnaires were collected (11 students did not filled out the questionnaire). The number of non-course students who

filled out OHKQ at both the beginning and end of semester was 19. Characteristics of research subjects is shown in Table 1.

The correct percentage of each OHKQ of the two groups is summarized in Table 2. At the beginning of the semester, there was no significant difference in the correct percentage of the two groups in the 16 questions, indicating that the general knowledge of dentistry was similar between the two groups.

After a semester of study, the correct percentage of 11 out of 16 questions at the end of the semester was significantly higher for the course students, indicating that the general education course Oral Science had a positive effect on improving the knowledge of dentistry among undergraduate students. Although these questions only involved common oral problems in clinical practice, students' understanding of these problems was insufficient. In 5 of the 16 questions (question 5, 8, 13, 14, 15), both groups achieved a correct percentage of more than 70% at the beginning and end of the semester. The knowledge of dentistry involved in these questions includes: the identification of dental calculus, predisposing factors for oral cancer, the significance of dental scaling, the manifestations of common oral diseases, and the causes of dental caries, indicating that the general public can access correct information related to these issues in their daily lives.

In 8 of the 16 questions (question 1, 2, 3, 4, 7, 9, 10, 16), the correct percentage of the first answer of both groups was less than 50%. The oral knowledge involved in these questions includes: the identification of caries

Table 1 Characteristics of subjects

Characteristics	Course students		Non-course students
	Completed the OHKQ three times	Filled out the questionnaire in the middle of the semester	Completed the OHKQ twice
Total number	92	89	19
Gender			
Male	59	57	14
Female	33	32	5
Major			
Art	6	6	0
Science	10	10	0
Engineering	35	33	19
Medicine	34	33	0
Management	7	7	0
Grade			
Grade 1	82	79	10
Grade 2	6	6	1
Grade 3	3	3	4
Grade 4	1	1	4

Table 2 The correct percentage of 16 questions in the Oral Health Knowledge Questionnaire

Question	The correct percentage of the course students (%)			The correct percentage of the non-course students (%)	
	Before the first class	After the first class	At the end of the semester	At the beginning of the semester	At the end of the semester
1	20.7	87.0	69.6	21.1	31.6 **
2	17.4	92.4	76.1	26.3	21.1 ***
3	32.6	69.6	57.6	36.8	31.6 *
4	16.3	77.2	72.8	21.1	15.8 ***
5	84.8	96.7	96.7	84.2	94.7
6	73.9	92.4	92.4	89.5	68.4 **
7	8.7	63.0	50.0	21.1	5.3 ***
8	92.4	100.0	96.7	89.5	89.5
9	35.9	93.5	83.7	42.1	36.8 ***
10	47.8	96.7	95.7	36.8	47.4 ***
11	78.3	98.9	97.8	68.4	68.4 ***
12	81.5	100.0	98.9	78.9	63.2 ***
13	87.0	97.8	97.8	89.5	94.7
14	94.6	97.8	97.9	94.7	94.7
15	98.9	98.9	98.9	89.5	89.5
16	27.2	88.0	81.5	21.1	21.1 ***

* , ** , *** indicates that there is a significant difference in the correct percentage of the question between two groups at the same time point (*: $P < 0.05$; **: $P < 0.01$; ***: $P < 0.001$)

and dental defects, the prevention of dental caries, the management of bleeding gums, chewing habits, oral hygiene measures, periodontitis.

From the scores of the three OHKQs of the course students (Fig. 1), due to the acquisition of immediate memory through the first lesson, the score of the questionnaire

filled out after the first class was the highest, and by the end of the semester, the score had decreased, but still significantly improved compared to that before the first class. According to the overall answering situation of the 16 questions at the beginning and end of the semester between the two groups, there was no significant

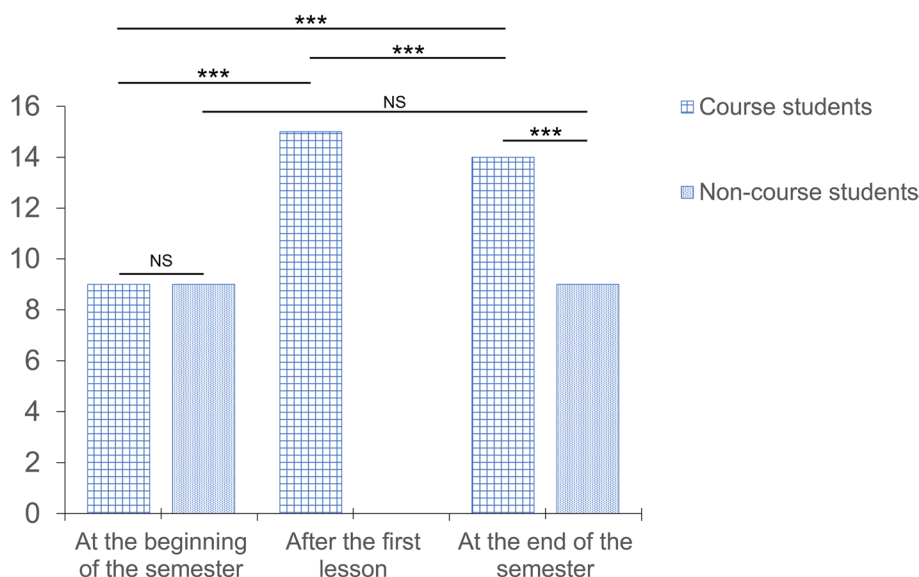


Fig. 1 The median score of each oral health knowledge questionnaire

difference in scores of the two groups at the beginning of the semester. However, the score of the course students was significantly higher than that of the non-course students at the end of the semester.

From the three OHKQs of the course students (Fig. 2A), a relatively high proportion of students answered incorrectly the first time and answered correctly the last two times, indicating that through learning, students can correct their previously incorrect oral cognition and still remember the correct answers after one semester. On the other hand, according to the results of the two OHKQs filled out by the non-course students (Fig. 2B), the majority were either both correct or both incorrect, indicating that the general public has few opportunities to effectively improve their oral hygiene knowledge in their daily lives.

Most of the course students had already discovered one or more oral problems of their own (Supplemental Fig. 3A), but 84% of the students did not take the initiative to visit a dentist for oral examination before taking this course (Supplemental Fig. 3B), indicating that the general public does not pay much attention to oral health.

Although the course students have found that they have various oral problems, most of them had a positive attitude toward their oral health status, with 90% rating themselves at least 6 out of 10 (Supplemental Fig. 3C). After taking Oral Science, 9% of the course students had already taken the initiative to visit the dentist for a dental check-up (Supplemental Fig. 3D), and 89% planned to have a dental check-up in the near future. The results show that the Oral Science course has a positive impact on improving the oral health behavior of undergraduate students.

Discussion

In this study, we evaluated the impact of the general education course Oral Science offered by Guanghua School of Stomatology, Sun Yat-sen University. General education is an essential and critical piece of the overall undergraduate educational experience [8]. The Association of American Colleges and Universities (AAC&U) has defined general education to be “the part of a liberal education curriculum shared by all students [8]. General education provides broad exposure to multiple disciplines and forms the basis for developing important intellectual and civic capacities” [9]. Nowadays, many institutions developed a general education curriculum that uses a distribution model in whole or in part. According to a survey of members of AAC&U, 80% use some type of distribution requirement in their general education program [10]. Sun Yat-sen University also has similar requirement, requiring each college to offer general education courses. Oral science is a general education course offered by Guanghua School of Stomatology for undergraduate students majoring in non-stomatology.

By comparing the answers of the course students and the non-course students at the beginning of the semester, there was no statistically significant difference in the score and correct percentage of each question, indicating that the level of knowledge in dentistry is similar when undergraduates of different majors do not take the general education course of Oral Science. Comparing the answers of the two groups at the end of the semester, it can be seen that the learning of this course can effectively improve the students’ general knowledge of dentistry. It is shown that whether or not students have gone through

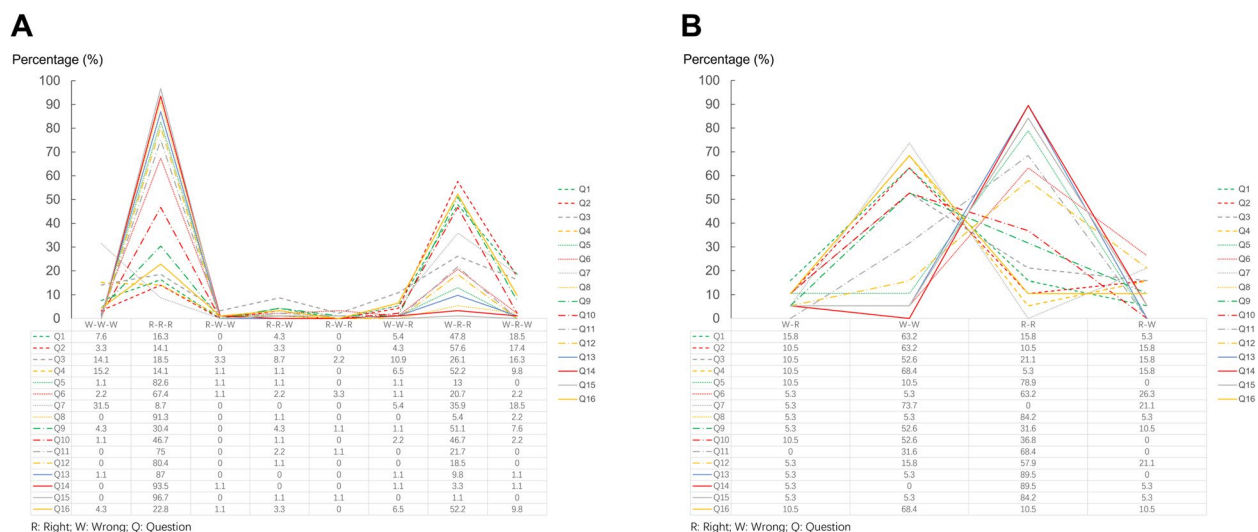


Fig. 2 Correct and incorrect situations of the Oral Health Knowledge Questionnaires **A** Questionnaires filled out by the course students; **B** Questionnaires filled out by the non-course students

of Oral Science has a significant impact on whether they can correct their original incorrect oral cognition.

The results of the questionnaire explain from a certain perspective why the prevalence of caries and periodontitis is so high in China [1], and the incidence of cracked teeth is high clinically, suggesting that dentists need to popularize more comprehensive oral health knowledge to the public through multiple channels.

The questionnaire survey conducted in the middle of the semester found that many students knew they had oral problems and had never sought medical attention for years. A study in the United States found similar findings that more than 40% of adults in the US have reported pain in their mouth in 2021 and 25% of American adults had untreated dental caries in their mouths [11]. It can be seen that the general public does not pay enough attention to oral health, and the awareness of oral disease prevention is not strong [4, 12]. Many people have misunderstandings about preventive dentistry, which may be one of the important reasons for the low rate of oral examination [13]. Regular dental check-ups can not only reduce the number of emergency dental visits caused by toothache, but also greatly reduce the economic expenditure of oral treatment [14, 15]. The understanding and awareness of oral health among the general public should not only be limited to treating diseases, but should also be strengthened from a preventive perspective [16]. After studying Oral Science, most students have planned or even undergone oral examination, indicating that this general education course has a positive effect on improving undergraduate students' oral hygiene behavior, changing their attitude toward oral examination from treatment-oriented to prevention-oriented.

The results of this study highlight that the general education course of Oral Science not only enriches students' knowledge of dentistry, but also improves their oral health, showing its positive and effective role in promoting oral and overall health. However, although the content of the questionnaire survey is covered in the teaching process of the course, not all students can effectively absorb knowledge, and few questions can achieve a 100% correct percentage. It can be seen that the popularization of oral health knowledge requires more diverse means and multiple repetitions. In the general education course of Oral Science, what we should teach, how to teach, and how to improve students' acceptance of knowledge are still the challenges that teachers of this course need to continue to explore.

Different from the stomatology-related specialized courses for undergraduates majoring in stomatology, the general education course of Oral Science is designed for undergraduates majoring in art, science, engineering, and medicine, etc. Through teaching practice, we found that

the students of this course generally lack the motivation to learn, and quite a few students take this course only to meet the credit requirements. It may be that the knowledge learned in the course is not easy to connect with the reality of life, resulting in low motivation for students. The results also indicate that students' awareness of oral disease prevention is generally weak, and the emphasis on this aspect in the curriculum needs to be strengthened. Through this study, we understand the role of Oral Science general education course in improving students' knowledge of dentistry and improving their oral hygiene behavior. This will help to strengthen the weak links in this course and improve the teaching quality in the follow-up teaching practice, so that non-dental undergraduate students can acquire knowledge through this course and apply it. According to the report Healthy People 2020, oral health is integral to overall health and access to dental services is essential to promoting and maintaining good oral health. The concept of prevention first is relatively weak among undergraduate students and urgently needs to be strengthened. Most oral diseases are preventable and controllable. For example, dental caries is almost completely preventable but many people are unaware of the need to access to preventive care. Therefore, in addition to proper oral hygiene maintenance, regular dental check-ups are very important, and these concepts should be repeatedly emphasized in future courses.

Access to dental care is a critical problem. Although most students perceive that they have dental problems, more than 80% of the students have never accessed dental care before the course. If it weren't for dental pain, patients would rarely have thought of searching for dental care, leading to a delay in treatment. Many factors influence the ability to access dental care. It was reported that cost was the most common barrier to not obtaining dental care [17–19]. Students have a limited ability to pay the high costs associated with dental care because they have no income. Other external barriers include inability to obtain dental insurance, dental provider shortages, lack of interdisciplinary collaboration, inadequate dental care for the underserved, and a complex oral health system that can be difficult to navigate. In addition, universities usually do not have on-site dental care, limiting access and creating barriers to undergraduates' dental services. Internal barriers include low oral health literacy (OHL), fear, and anxiety associated with dental care, perceptions and misconceptions about preventive oral health care [13, 17]. The term OHL refers to the capacity to acquire, process, comprehend, and act upon basic oral health information [13]. OHL has been identified as a major internal barrier. It is vital to understand how OHL affects an individual's ability to access and navigate the oral health care system and implement preventive oral health

practices. There are numerous misconceptions concerning oral health within the undergraduate students. Our study revealed that while many undergraduate students believe oral health is important, they do not receive regular dental care. Influences may include outdated dental health information; insufficient dental perceptions. Many of their dental perceptions and oral hygiene habits originate in childhood and continue to influence them. Low OHL is also associated with decreased utilization of preventive dental services and increased utilization of emergency department services [20]. There is a causal relationship between OHL and oral health behaviors, however, their complex relationship needs further studied. Guangzhou city, where Sun Yat-sen University is located, is one of the largest cities in China, so undergraduate students at Sun Yat-sen University do not live in dental professional shortage areas. However, their oral health status and oral prevention awareness are not high. It can be imagined that undergraduate students living in other areas will have less access to dental care, and worse oral health and oral prevention awareness. Therefore, it is of great significance to improve students' OHL through the study of Oral Science, and then increase the use of dental services. Although the general education course of Oral Science cannot address all factors, we can focus on improving a few of them, and try to eliminate some barriers associated with access to dental care.

It was said that general education courses should be among the best in the university, but they are also the hardest to teach well [8]. The original intention of offering this course is that through the study of Oral Science, students can improve their knowledge of dentistry and apply what they have learned to their personal life, and effectively improve their oral hygiene. The implementation of the course is expected to be benefit for strengthening oral health education for the whole population. For curriculum teachers, the first thing we need to understand is the distinction between "specialized" and "general" education, the requirements for preparing for a specialized, disciplinary curriculum are very different from preparing for a general education course. In the subsequent teaching practice, various ways can be tried to encourage students to connect the theoretical knowledge of Oral Science with the practical life, so as to train students' learning, connection and analysis skills. The 8 questions with an initial accuracy percentage of less than 50% cover the areas of identification of caries and dental defects, prevention of dental caries, management of bleeding gums, chewing habits, oral hygiene measures, and periodontitis. These areas may be the least likely area for the general public to have access to correct oral health information in their daily lives. In the future, more emphasis should be placed on teaching relevant knowledge in the Oral Science

course. Not only should students master the knowledge, but they should also be encouraged to promote and popularize it, so as to improve the population's awareness of oral health. Hereafter the reform of the general education course of Oral Science should consider multiple scenarios to provide students with comprehensive and easy-to-understand dental health information. Teachers should continue to explore other teaching methods to improve the teaching quality of oral science, which is paramount to addressing oral health needs.

Conclusion

The general education course of Oral Science can significantly improve undergraduate students' general knowledge of dentistry and effectively improve their oral hygiene behavior. However, the popularization of oral health sciences should be extensively promoted, and general knowledge of oral health should be vigorously endorsed, to guide undergraduate students toward establishing correct oral health concepts and forming a scientific oral health habit. We should continue to work hard to improve the learning motivation of the course students, strengthen their awareness of oral prevention, and improve the teaching quality of Oral Science.

Limitations

There were some limitations to this study. In this study, students filled out the questionnaire voluntarily. The number of students from control group (non-course students) in the study was limited because they had to filled out the same questionnaire twice, at both the beginning and end of the semester. This study was conducted only in one university, and due to the inconsistency of the curriculum of different universities and the differences in university levels, the results of this study might not represent the situation of most universities. The questionnaire did not cover all basic oral knowledge, which might lead to a lack of comprehensive understanding of students' knowledge mastery. The understanding of students' oral health status in this study was only based on students' self-evaluation, and no oral examination was designed, which might not be accurate enough.

Supplementary Information

The online version contains supplementary material available at <https://doi.org/10.1186/s12909-024-06062-1>.

Supplementary Material 1.

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Authors' contributions

Q.H. and Z.L. designed the experiments. Z.L. supervised this work. Q.H., X.L., L.C. and S.H. collected and analyzed the data. All authors participated in the design of the questionnaires, read and approved the final manuscript.

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Availability of data and materials

All data generated or analysed during this study are included in this published article and its supplementary information files.

Declarations

Ethics approval and consent to participate

All methods were performed in accordance with the Declaration of Helsinki. Informed consent was obtained orally from all subjects. Ethical approval was obtained from the Medical Ethics Committee of the Hospital of Stomatology, Sun Yat-sen University (Institutional Review Board no. KQEC-2024-06-01).

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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