

Comparison of oral health care between dental and non-dental students in Southwestern China—exploring the future priority for oral health education

Mingming Li

Sichuan University West China College of Stomatology

Zhiwu Wu

Sichuan University West China College of Stomatology

Rui Zhang

Sichuan University West China College of Stomatology

Lei Lei

Sichuan University West China College of Stomatology

Ran Cheng (✉ chengran@scu.edu.cn)

Sichuan University West China College of Stomatology <https://orcid.org/0000-0001-5590-3395>

Tao Hu

Sichuan University West China College of Stomatology

Research article

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Abstract

Background

Dental caries and periodontal disease are still serious oral problems in China after decades of Oral health education(OHE). It's necessary to figure out the problems. The aim of this study was to figure out the oral health care knowledge and habits of undergraduates in Sichuan University and the existing problems, by comparing the differences between dental and non-dental students. It was hoped to provide some suggestions for future OHE.

Methods

A quasi-experimental study design with a pre-test and post-test group was applied. 217 dental-students and 135 non-dental students were enrolled. They were given a course for OHE. A knowledge test and a survey about oral health care were conducted before and after course.

Results

According to the pre-course survey, dental students surpassed non-dentals in terms of tooth-brushing frequency, method, time and flossing. Unfortunately, flossing was overlooked by all the students. After the course, both dental and non-dental students improved a lot in the oral health care knowledge and habits. More non-dental students than dental students were willing to use toothpicks and Chinese herbal toothpaste before and after course.

Conclusions

OHE plays a positive role for university students. Future OHE should focus on the flossing, toothbrushing methods, toothpick, Chinese herbal toothpaste and modification to adapt new media.

Background

Oral disease is a worldwide epidemic problem and has imposed huge burden [1]. The number of people with untreated oral conditions worldwide increased from 2.5 million in 1990 to 3.5 billion in 2015, with a 64.0% increase in disability-adjusted life years due to oral conditions [2]. Among them, untreated dental caries, severe periodontitis, and missing teeth are three most common and influential oral diseases [1].

Fortunately, most oral diseases, especially dental caries and periodontal diseases are largely preventable. Among various approaches, the most costeffective method is health education [3]. Oral health education (OHE) has been a part of services for disease prevention since 1900s [3]. OHE could improve oral behaviors, such as toothbrushing and flossing, to decrease dental plaque accumulation [4]. As a result,

OHE can improve oral health to some extent [4]. It is also effective in improving the knowledge, attitude and practice in reducing the plaque, gingival bleeding and caries increment [5].

In China, OHE has been conducted for years. National campaign “The National Teeth Love Day” was set in 1989 and has put forward a topic for oral health education every year [6]. After decades of effort, the national survey in 2015 showed that approximately 60.0% of citizens had basic knowledge regarding oral health and 84.9% of them had a positive attitude [7]. However, the caries rates of children aged 3–5 and elderly aged 65–74 were 62.5% and 98.0% respectively, which were much higher than 10 years ago. And 87.4% adults between 35–44 years old suffered from gingival bleeding [7]. Dental caries and periodontal disease are still serious oral problems in China.

Due to the large population of China and shortage of dentists, the dentist-to-population ratio was 1:10,000 [8]. OHE should be even more focused and efficient. The children's oral health mainly depends on their parents' correct guidance over a long period of time [9]. Many surveys revealed that parents' attitudes and behaviors were associated with children's oral health behavior [10–12]. As for elderly, several reports showed that their oral health were positively correlated with education [13, 14]. China has a large number of old and under educated people [15], which brings great burden to the OHE. But the offspring may benefit the elderly's health by transferring knowledge and practice [16–18]. Therefore, it might be more efficient to educate the adults who assume the triple roles of themselves, parents and children.

The in-school undergraduates are young adults and will become parents in a few years. Comparing to adults who are busy working or feeding children, they have more time to receive education. At the same time, with a high educational level, they are more capable of accepting knowledge of oral health. It was verified that OHE could positively change the behavior of college students [19]. Furthermore, they tend to pass on the knowledge to their parents, or transferring oral health awareness and behavior to future offspring(s). Last but not least, college courses are comparably easy to arrange for OHE. However, the oral health knowledge and habits of university students were not included in the recent national survey. Here we aimed to figure out the oral health status of undergraduates in Sichuan University and the existing problems, by comparing the differences between dental and non-dental students. It is hoped to provide some suggestions on OHE for both dental and non-dental university students in the future.

Methods

Participants

The third-year undergraduate dental students (the first year in their professional dental education) were enrolled. The inclusion criteria were: the third-year dental students of Sichuan University; agreed to participate in the survey. The exclusion criterion was: the answer was incorrectly written.

The 2 ~ 4-year non-dental students were enrolled. The inclusion criteria were: in school students of Sichuan University; agreed to participate in the survey. The exclusion criteria were: dental students; the

answer was incorrectly written.

By comparing the proportions of two independent samples, the calculator

$$(1 + 1/k)(\mu_{\alpha} + \mu_{\beta})^2 p(1 - p) / \delta^2$$

was applied [20]. A pre-test about toothbrushing frequency of dental and non-dental students was carried on. The samples were estimated to be more than 110 in each group.

Design

A quasi-experimental survey with a pre-test and post-test group was performed for the study.

Intervention and instruments

The dental and non-dental students received the pre-course survey on knowledge and habits of oral health care before the lecture. The OHE was scheduled in a 90 minutes course by the same teacher. The content was designed based on the textbook "Preventive Dentistry" [6]. The methods of toothbrushing, interproximal brushing, gargle and tongue cleaning were introduced. A post-course survey including the same items was handed out after the course.

Data collection and analysis

The questionnaires were completed by students online. For the scale items in the questionnaires, we used SPSS 16.0 (IBM Corp. New York, NY, USA) to analyze the Cronbach's alpha coefficient. 6 experts (1 professor, 3 associate professor and 2 lecturers) evaluated the content validity [21], clarity, conciseness of the questionnaires. The data were presented as percentages, means and standard deviation (SD). The Wilcoxon signed-rank test, Chi-square test and Fisher's exact test were used for statistical analysis by using SPSS 16.0. $P < 0.05$ was regarded as statistically significant differences.

Results

In the pre-course survey, 217 third-year undergraduate dental students (86 male, 131 female; aged 21.3 ± 1.0 years) and 135 non-dental students (55 male, 80 female; aged 21.4 ± 0.8 years) were enrolled. In the post-course survey, 1 student in non-dental group was excluded as a result of incorrect writing. The non-dental students were in grade 2 to 4. They were from 17 departments of Sichuan University and their majors were displayed in Fig. 1.

Reliability analysis of the scale items of a simultaneous survey showed that cronbach's alpha coefficient was 0.781 for the pre-course survey and 0.711 for the post-course survey. For this survey with non-scale items, the reliability was considered as acceptable when the same group completed the questionnaires at the same time. A content validity index (CVI) was calculated for questionnaire items. The item-level CVIs and the scale-level CVIs were 1.

First of all, we surveyed the oral health care frequency of dental and non-dental students before and after course (Fig. 2). Before the course (Fig. 2c), most students in both groups did well in brushing their teeth twice a day. However, the students rarely used interproximal tools (Fig. 2c). Up to 71.9% of students in non-dental group and 40.6% in dental group never used floss. But dental group was still significantly better than non-dental group ($P=0.000$). There was no obvious difference between two groups in the use of interproximal brush or toothpick ($P>0.05$). After the course (Fig. 2d), almost all the students were tended to brush the teeth twice a day with the proportion increased from 93.6–99.5% in dental group ($P=0.001$) and 83.7–94.8% in non-dental group ($P=0.004$). The dental group was more willing to use dental floss or use more often ($P=0.000$). However, 20% of non-dental students were still reluctant to floss even after the course. Compared to dental-students, non-dental students were more willing to use toothpicks ($P=0.016$). In short, dental group performed better than non-dental group in toothbrush and floss before and after course. Table 1 showed students' knowledge about water/air floss. Before the course, both groups were unfamiliar with the tools. The course introduced new flossing equipment for them.

Next, we surveyed the toothbrush method (Fig. 3a). The Bass or modified Bass method was recommended by the Chinese Stomatological Association. 66.8% of dental students were using the Bass method, which overwhelmed non-dental students (18.5%) ($P=0.000$). Meanwhile, 20.7% of non-dental students were still using the wrong horizontal-method and 20.7% of them didn't know the in-use methods. Table 2 showed the knowledge of Bass method between two groups. It revealed that dental students performed much better than non-dental students before the course ($P=0.000$), which was in accordance with their habit described above. The course increased students' knowledge and willingness to use the Bass method, especially for non-dental students ($P=0.001$). But the tendency of Bass method usage in non-dental group was still much lower than dental group ($P=0.000$). With regard to the brushing time (Fig. 3b), dental students performed generally better than non-dental students before ($P=0.000$) and after ($P=0.025$) course. The proportion of students who were willing to brush the teeth over 2 minutes increased from 83–97% in dental group ($P=0.001$) and 56–94% in non-dental group ($P=0.000$) after the course.

Then, we investigated the types and the replacing frequency of toothbrush (Fig. 4). Before the course, more than half of the students in both groups preferred electric toothbrush to manual toothbrush (Fig. 4a). But the actual usage or willingness to use (45.2% in dental group and 38.5% in non-dental group) was lower than that (Fig. 4b). After the course, more dental students thought electric toothbrush was better and would like to use it. Considering softness of bristles (Fig. 4c), soft-bristled toothbrush was favored after the course ($P=0.01$ in dental group, $P=0.012$ in non-dental group). Toothbrushes need to be replaced regularly and most students had a good habit for changing their toothbrushes within 3 months (Fig. 4d). There was no obvious difference in these 2 items between two groups ($P>0.05$).

Finally, we did the research about students' considerations when selecting toothbrush and toothpaste (Fig. 5). Before the course, function and price were the aspects that most students cared about (Fig. 5a,b). After the course, more students in both groups realized the importance of function ($P=0.000$), and the number of those who cared about the popularity and were confused to choose decreased ($P=0.000$).

About the function of toothpaste (Fig. 5c), non-dental students preferred Chinese herb, whitening and fluoride toothpastes before the course, while dental students preferred fluoride, Chinese herb and desensitize toothpastes. After the course, the proportion of dental and non-dental students choosing fluoridated and desensitized toothpaste increased significantly ($P = 0.000$). Fewer dental students and more non-dental students were willing to use Chinese herbal toothpaste ($P = 0.000$), and the two groups showed opposite trends.

Discussion

The 4th Chinese National Oral Health Survey showed that the problems of caries and periodontal diseases were still serious in China. Education for the adults might be an efficient way for OHE. For the concern, we tried to focus on undergraduates, hoping to improve themselves and indirectly helps the elderly and children.

Previous study showed that oral health care awareness and behaviors of dental students were better than non-dental students [22]. For dental students in Sichuan University, simple education for oral health was set up in their first year. Some clinical research or practice was open to them, e.g., the university students' innovation and entrepreneurship training program. Also, some of them had opportunities to get in touch with seniors and may obtain information. These OHE-related pre-clinical education and practices could enhance their knowledge about oral health care. For non-dental students in this University, they had similar educational background with dental students. So, they might be able to receive the same simple education for oral health. And these knowledges were almost enough for the daily care. Therefore, we used the dental group as a reference to find the differences of oral health care between two groups. Also, we explored the role of OHE on both dental and non-dental students by comparing their oral health knowledge and attitude before and after course.

The study investigated the oral health care habits of dental and non-dental students. The tooth brushing frequency was well known among all the students. However, half of non-dental students didn't meet the recommended brushing time of two minutes. Additionally, non-dental students had difficulty in selecting tooth brushing method. The (modified) Bass method, the Roll method, the Fones method and horizontal method are the most widely used brushing methods [23]. Several studies have shown that the (modified) Bass technique was effective in controlling dental plaque and alleviating gingival inflammation [24, 25]. Horizontal method, which could result in wedge-shaped defect [26], was not recommended. But it was a common method in China. In this survey, only 18.5% of non-dental students used the Bass method, 20.8% of them used horizontal method and 20.8% knew little about methods. From the result, we found that although non-dental students had good knowledge and tooth-brushing frequency, the actual brushing methods may not be appropriate enough. After the education by the course, much more non-dental students were willing to use the Bass method.

It was worth noticing that interproximal cleaning was overlooked by both dental and non-dental students. It was surprising that quite few dental students floss for daily cleaning. The findings revealed the sign of

the ignorance about interproximal cleaning in China. Floss is so efficient that it can remove up to 80% of plaque [27]. However, floss is comparably difficult to use and this may limit its application [28]. Therefore, the dexterity and learning ability should be taken into account. Undergraduates are quite eligible learner for this concern. Interestingly, the tendency of using toothpick increased among non-dental students after the course. Toothpick is quite popular in China and can be found in restaurants and take-away-cutlery easily. OHE on toothpicks should be strengthened to minimize periodontal damage caused by improper use.

Later, the choice of toothbrushes was surveyed. Function and price were the most important considerations. Many studies have confirmed that electric toothbrush was more effective than manual toothbrush [29, 30]. Before the course, more than half of the students in both groups thought electric toothbrush was better than manual toothbrush. But the actual use rate was much lower than that, especially in non-dental group. Price might also be a possible reason. The nation-wide usage is much lower. A report showed that the penetration rate of electric toothbrush in China was only 5%, while in some developed countries was more than 15%, even up to 40% [31] After introduction about electric toothbrush through the course, more students realized its advantages and were intended to use, even with a relatively high price.

When choosing toothpaste, function and price were also the first two considerations. Interestingly, more non-dental students than dental students were willing to use Chinese herbal toothpaste before and after course. As a part of traditional Chinese medicine, Chinese herbal toothpaste may have some effects in alleviating gingival inflammation [32]. Several studies showed that Chinese herb even had effect on preventing caries [33]. The Chinese herbal toothpaste was preferred by traditional Chinese. Its correct usage should be focused on in the future OHE course, e.g., do not substitute scaling for Chinese herbal toothpaste.

One thing cannot be ignored is that some students cared about the popularity when choosing toothpaste and toothbrush. This brings us a new way of OHE—new media. Recently, a large number of popular media platforms have emerged, such as Tiktok (video platform), WeChat (social media platform) and Taobao (shopping platform), etc. New media has a wide range of young users [34]. OHE might attract more attention if it is edited and delivered on these platforms. The modified OHE may be much more popular, convenient, low cost and easier to learn than before.

In all, the OHE course improved the oral health knowledge and habits among both dental and non-dental students. Dental students had much better performance than non-dental students before course. The result was in accordance with previous study [22]. Dental students surpassed non-dental students in terms of tooth-brush frequency, method, time and floss use. For both dental and non-dental students, a single course could improve their oral health care knowledge and habits a lot. It was demonstrated that OHE plays a positive role for university students. The future OHE should pay more attention to the floss, toothbrushing methods, toothpick, Chinese herb toothpaste and modification to adapt new media.

Limitations

Due to the time constraints, we conducted the after-course survey in a short period of time. So, we could only know the change of students' knowledge and attitude towards oral health care, the actual habit is unknown. The final effect of OHE for undergraduates and their parents or offspring(s) needs further verification.

Conclusion

According to the pre-course survey, dental students surpassed non-dentals in terms of tooth-brush frequency, method, time and floss use significantly. Floss was overlooked by all the students. After the course, both dental and non-dental students improved a lot in the knowledge and habits. Future OHE should focus on the floss, toothbrushing methods, toothpick, Chinese herb toothpaste and modification to adapt new media.

Abbreviations

OHE: oral health education; CVI: Content validity index

Declarations

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Availability of data and materials

The main data used to support the findings of this study is included within the article. The datasets generated and analyzed during the current study are available from the corresponding author (chengran@scu.edu.cn) on reasonable request.

Authors' Contributions

RC and TH contributed to the design of the study. ML and ZW devoted to the data collection, analysis and manuscript writing. FZ assisted data collection. RC and TH contributed to manuscript revisions. All

authors commit themselves to the crucial revision of the paper and supported the final manuscript for publication.

Ethics approval and Consent to Participate

This study was supported by the Institutional Review Board of the Ethics Committee of West China Hospital of Stomatology, Sichuan University (WCHSIRB-D-2018-092). All the participating students had signed informed consent.

Consent for publication

Written consent from the participants was obtained.

Competing interests

ML, ZW, FZ, LL, RC and TH state that they have no conflict of interest.

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Tables

Table1 The knowledge about water/air floss

	Dental students	Non-dental students	<i>p</i> ^a
Before lecture	2.83±1.17	2.51±1.05	0.000
After lecture	4.51±0.51	4.31±0.55	0.000
<i>p</i>^b	0.000	0.000	

Wilcoxon signed-rank test; Scale: 1 (strongly unknown) to 5 (strongly knowledgeable)]

^a comparison between dental and non-dental students before or after class;

^b comparison between students before or after class.

Table 2 The knowledge about modified Bass method

	Dental students	Non-dental students	<i>p</i> ^a
Before lecture	4.23±0.75	2.83±1.16	0.000
After lecture	4.75±0.44	4.35±0.49	0.000
<i>p</i> ^b	0.000	0.000	

Wilcoxon signed-rank test; Scale: 1 (strongly unknown) to 5 (strongly knowledgeable)]

^a comparison between dental and non-dental students before class;

^b comparison between students before or after class.

Figures

Major of non-dental students

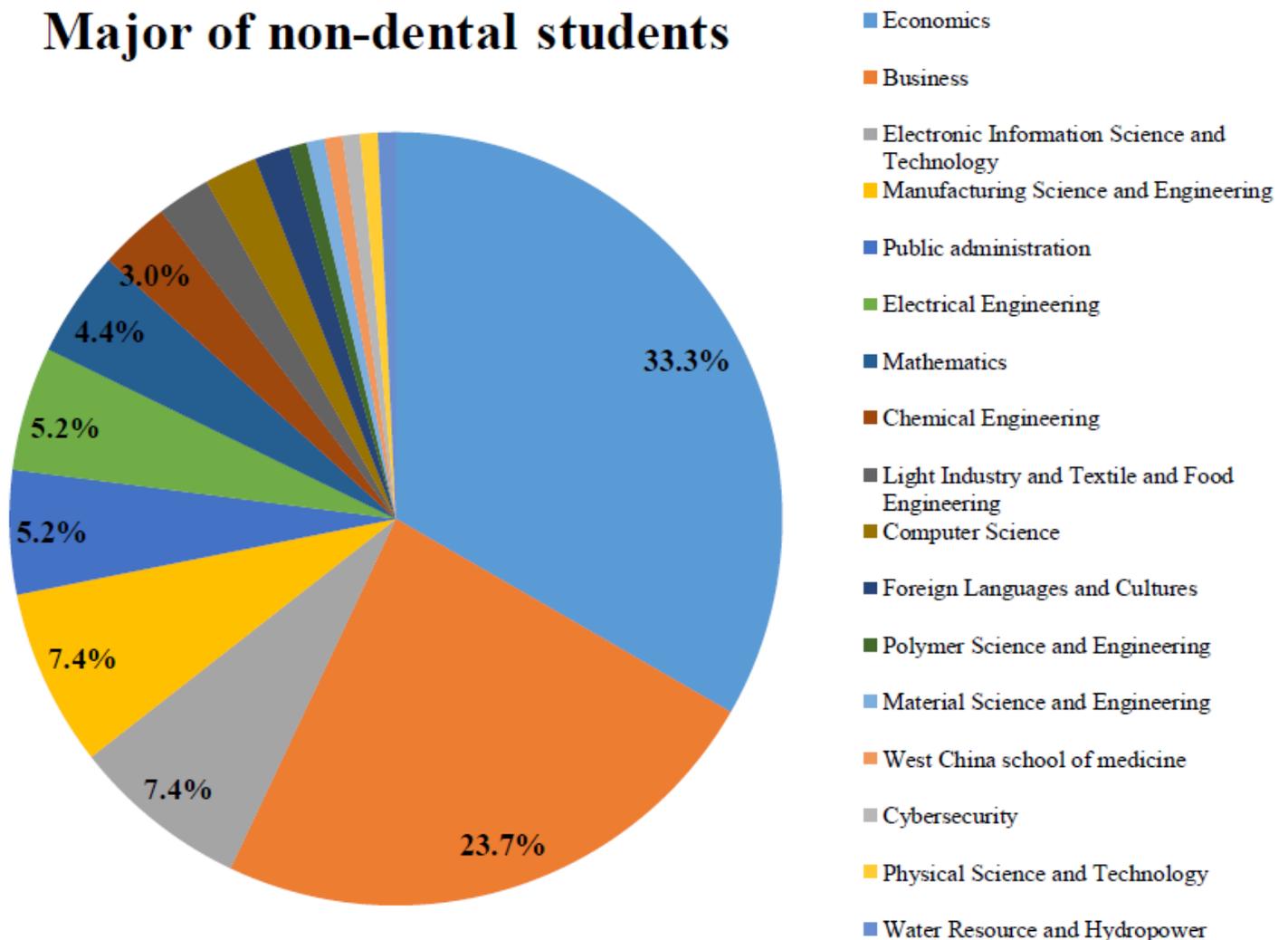
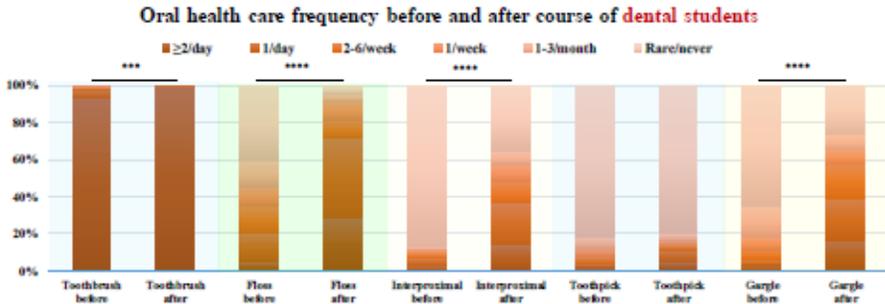
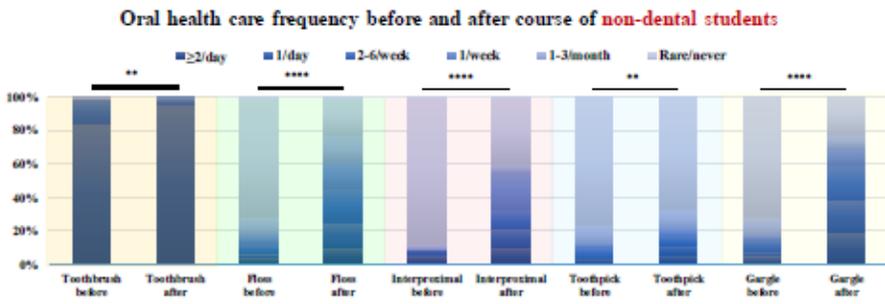


Figure 1

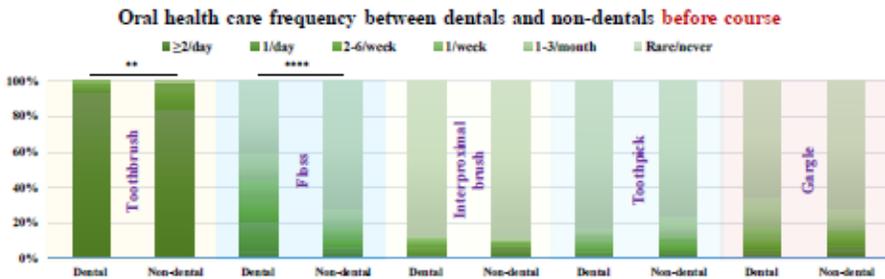
Major of the non-dental students. The top four were the Department of Economic, Business, Electronic Information Science and Technology and Manufacturing Science and Engineering.



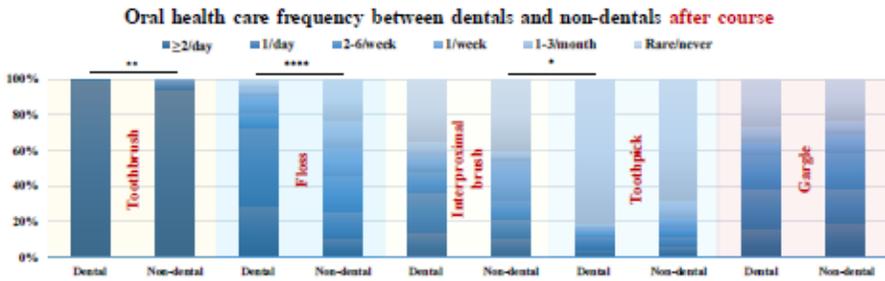
(a)



(b)



(c)

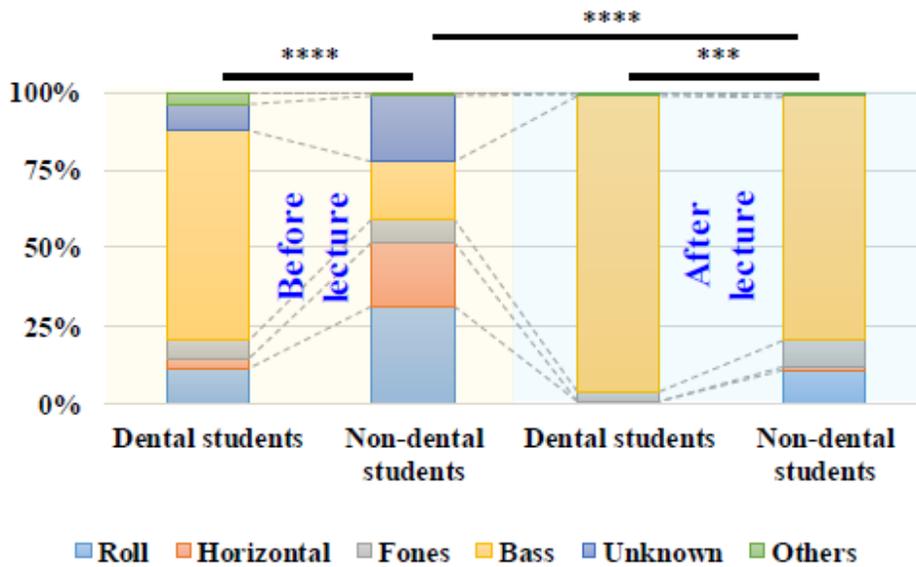


(d)

Figure 2

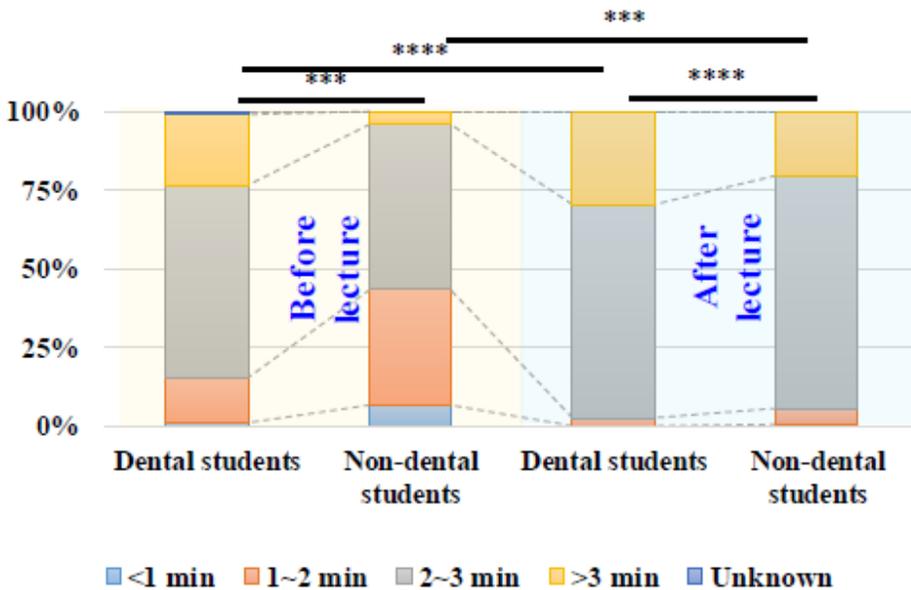
Oral health care frequency before and after course of dental students and non-dental. (a, b) Dental and non-dental students improved a lot in toothbrushing and interproximal cleaning after the OHE-related course. (c, d) Dental students surpassed non-dental students in toothbrushing($P=0.004$) and flossing($P=0.000$) before and after course. Non-dental students were more willing to use toothpicks after the course ($P=0.016$). (Wilcoxon signed-rank test; ****, $P=0.000$; **, $P=0.01$; *, $P<0.05$)

Toothbrushing methods



(a)

Toothbrushing time



(b)

Figure 3

The choice of tooth brushing methods and time. (a) Dental students overwhelmed non-dental students in the use of Bass method($P=0.000$). 20.7% of non-dental students were using the wrong horizontal-method. (b)Dental students performed generally better than non-dental students in toothbrushing time before($P=0.000$) and after($P=0.025$) course. (Wilcoxon signed-rank test; ****, $P=0.000$; ***, $P=0.001$)

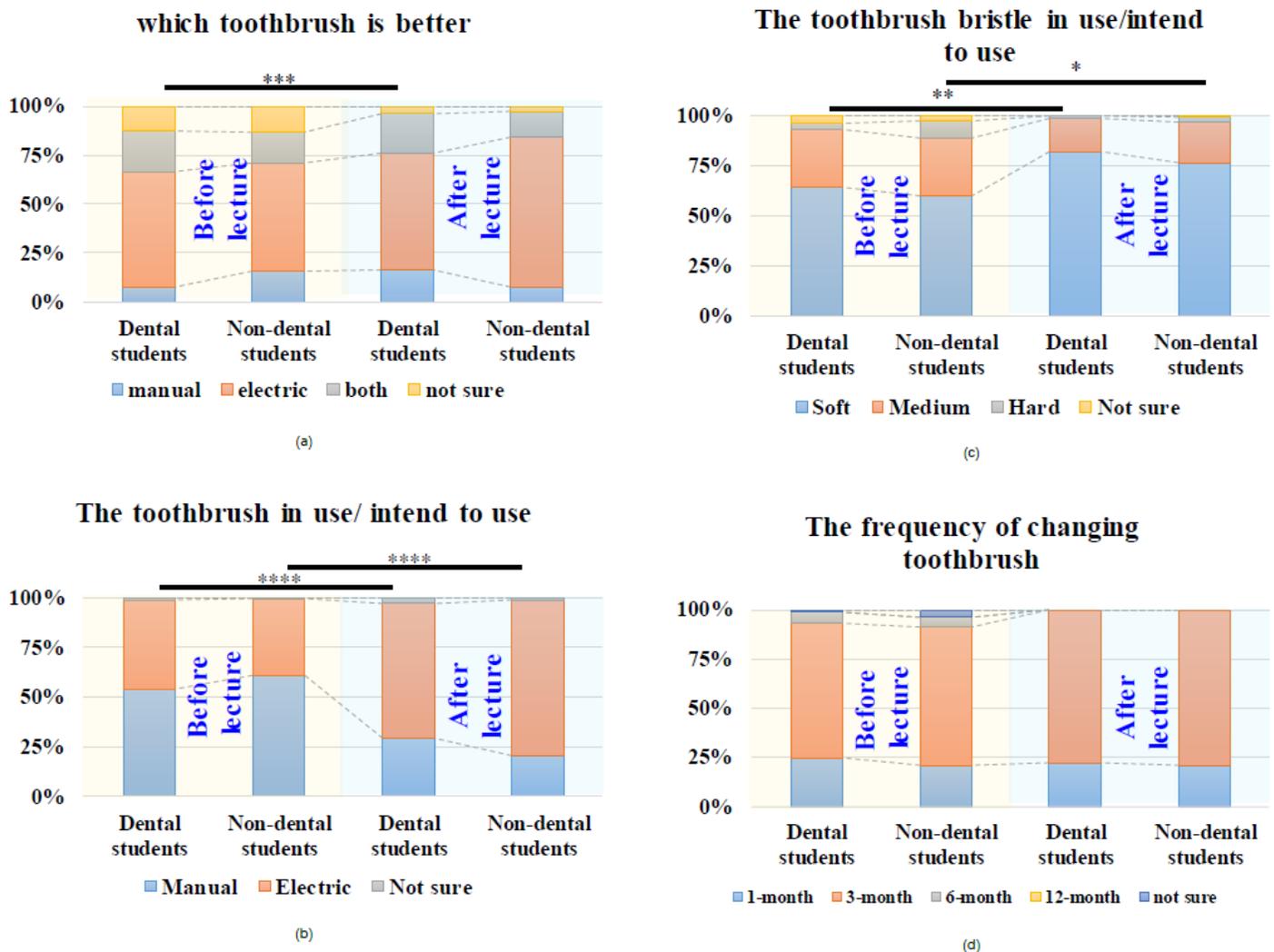
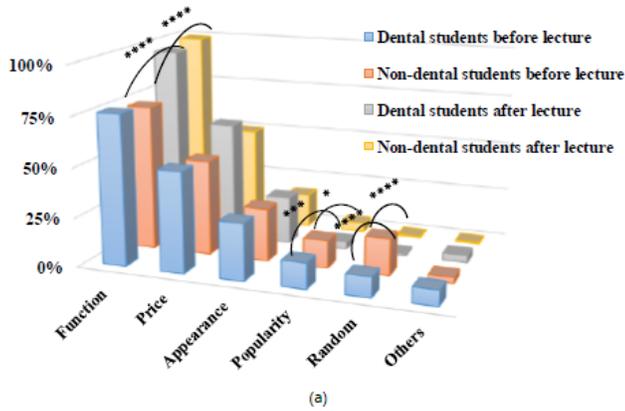


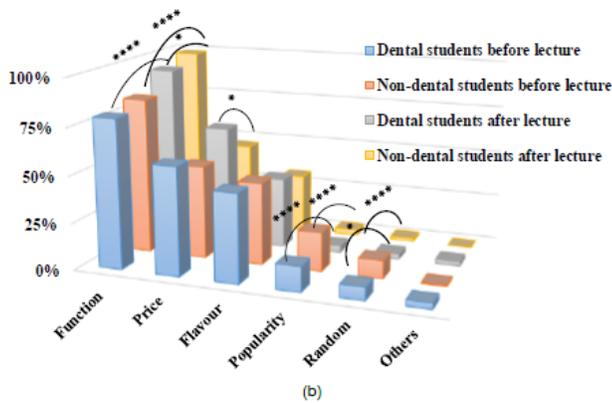
Figure 4

The types and replacement frequency of toothbrush of dental students and non-dental students. (a, b) Before the course, most students in both groups preferred electric toothbrush to manual toothbrush. But the actual usage of electric toothbrush was low. After the course, more dental students thought electric toothbrush was better. (c) Soft-bristled toothbrush was favored by more students after the course. (d) There was no obvious difference in the frequency of changing toothbrush between two groups($P>0.05$). (Wilcoxon signed-rank test; ****, $P=0.000$; ***, $P=0.001$; **, $P=0.01$; *, $P<0.05$)

How to choose toothbrushes



How to choose toothpastes



Types of toothpastes

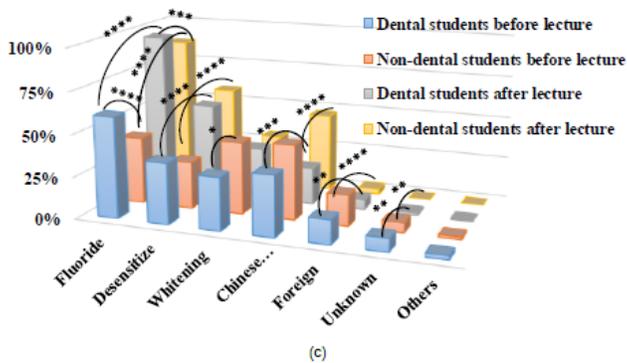


Figure 5

Dental students' and non-dental students' considerations when selecting toothbrush and toothpaste before and after course. (a, b) Function and price were the first two considerations. Some students cared about popularity before the course. (c) Non-dental students preferred Chinese herb, whitening and fluoride toothpastes before the course, while dental students preferred fluoride, Chinese herb and desensitize toothpastes. After the course, fewer dental students and more non-dental students were willing to use

Chinese herbal toothpaste($P=0.000$), and the two groups showed opposite trends. (Chi-square test or Fisher's exact test; ****, $P=0.000$; ***, $P=0.001$; **, $P=0.01$; *, $P<0.05$)