The establishment and effectiveness of a new clinic-based dental education method for medical students

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ABSTRACT

The aim of this study was to evaluate the effectiveness of a new clinic-based dental education method for medical students of China. This new clinic-based dental education method was designed and applied to stomatological clinical education in Capital Medical University in 2002, and included a database of typical clinical cases and related quizzes. The present study compared the effectiveness of this new education method versus the traditional education method at Capital Medical University of China. The effectiveness of this new teaching method was evaluated based on a final examination, a one-year follow-up examination, and questionnaires completed by students. Students were assigned to the new method of teaching, on average scored higher than students assigned to the traditional method of teaching on both final and one-year follow-up examinations, though this difference was not statistically significant. Questionnaires showed that cognitive speed, level of satisfaction, quality of education and overall scores accorded to the new method were significantly higher than those accorded to the traditional method (P<0.05). The database of clinical cases presented in the new method was appraised more informative by 90% of medical students, and more interesting by 95% of them. The clinic-based dental education method can promote the understanding of clinical knowledge, as well as improve the learning of clinical skills in dental education of medical students in China.

Key words: Medical students, dentistry, clinic-based dental education, China.

INTRODUCTION

The importance of dental knowledge to medical professionals has been acknowledged (Thompson, 1975; Curtis et al, 1985). Although, dental training of medical students varies greatly among medical schools both nationally as well as internationally, dental topics overall are perceived to be important in the vast majority of medical schools (Loster and Likeman, 2012). Dentistry has become an important component in the curricula of most Chinese medical schools. Traditionally, a narrowly defined course in dental science had been presented to junior medical students. Generally, those concepts being taught to dental students were presented in a scaled-down version to fit the limited time available for dental education in the medical school curriculum (Thompson, 1975). However, this teaching method, notably characterized by insufficient time for clinical application, caused the whole endeavor to be of questionable practical value to medical students at an early, non-clinical stage of their training. Therefore, the development of a new method of teaching dentistry to medical students is critical to their education.

Starting in 2002, we designed and gradually implemented a new system of teaching dentistry for medical students in Capital Medical University (Beijing, China). Clinical cases consisting of specially designed models and videos were used in teaching dentistry theories to medical students. This new teaching method revolutionized the traditional teaching mode, which itself rarely applies any clinical observational experiences prior to the conclusion of didactic theory lessons. In this new method, the clinic itself becomes the teaching and learning site, and includes theoretic education
concurrently with clinical observational experiences. This combination of clinical and didactic lessons leads to a better comprehension of the key concepts in dentistry. For this new method, a database of clinical cases and quizzes was established and played a key role in our new dental education system for medical students. To evaluate the effectiveness of the new teaching method, a comparative study was conducted to measure specific areas of student performance and satisfaction between the new clinic-based dental education method and the traditional education method.

METHODS

Study design

The study was approved by the Institutional Review Board of Beijing Anzhen Hospital Affiliated to Capital Medical University. Forty-three medical students in the class in 2005 at Capital Medical University were randomly divided into two groups. A control group consisted of six males and sixteen females and the study group consisted of six males and fifteen females. Ages and gender ratio of the two groups were similar. The control group (Traditional Teaching Group) was taught using traditional teaching methodology (didactic lessons followed by clinical observations). The study group (Clinic-based Dental Education Group) was taught using the new method (clinic-based teaching). All didactic teaching materials were modified from the same textbook, “Dentistry for Medical Students” (People’s Medical Publishing House, Beijing, China). The Traditional Teaching Group was taught in sequence: didactic teaching of theories followed by clinical observations, whereas didactic and clinical components were integrated together in the Clinic-based Dental Education Group. Both groups were taught by faculty with similar teaching experience.

A database of typical clinical cases was established. Clinical data of typical cases consisted of four components: medical history, physical examinations, diagnosis and differential diagnosis. A set of quizzes was attached to each clinical case.

To assess the effectiveness of the aforementioned database, medical students in the classes in 2007 and 2008 (Capital Medical University) were taught by the new clinic-based dental education method combined with this database of typical clinical cases. These classes were comprised of one-hundred and eighty-four students in total, among them, fifty-nine were males and one-hundred and twenty-five were females.

Assessment and data analysis

The assessment of the effectiveness of the new teaching method and the clinical database was conducted by two methods: closed-book examinations and psychological questionnaires.

Closed-book examinations

Final examinations and one-year follow-up examinations were conducted to compare the effectiveness of the new clinic-based dental education method versus the traditional dental education method for medical students. The examination questions were prepared by faculty in both the Clinic-based Dental Education Group and the Traditional Teaching Group. Questions were pooled together, then randomly selected by the study coordinator to form the final examinations for both groups. Books and other teaching materials were unavailable during the tests (closed-book tests). Examinations were graded and assessed by an independent faculty member. Scores were analyzed by an independent t-test using SPSS 11.5 software. All students were re-tested one year later with the same examination. Follow-up examinations were graded and scored in the same manner as the final examination.

Psychological questionnaires

Questionnaires were designed by a professional psychological research professor in the Department of Psychology of Capital Medical University to assess the qualities of education methods experienced by students. Questionnaires, which were designed to compare the effectiveness of the new versus traditional teaching methods included statements regarding cognitive speed, capacity of understanding, ability of learning, level of satisfaction, quality of teaching and overall score (sum of five scores). The options A, B, C were converted into number 1, 2 and 3. Questionnaires designed to evaluate the effectiveness of the clinical database included questions regarding whether the cases were typical, whether or not the cases helped students to learn, whether the cases improved the efficiency of learning and whether the cases promoted the clinical logic of students. Answers were arranged by level of agreement with each statement. There were three levels of agreement: Totally no, fairly, yes. When analyzed in numeric scale, they equaled one, two and three. Students of in both teaching groups were asked to fill out the questionnaires anonymously 5 min after the final examination. Figures 1 and 2 show the questionnaires used in this study.

Statistical analysis

A homogeneity of variance test was conducted between two samples in order to assess the equality of their variance, and a t-test of two independent samples was conducted.
Questionnaire evaluating the effectiveness of clinical-based education method

Design standard: (GB101sheet—J403) Standard of application: PRC Adult
Announcement
1. The time filling the sheet is restricted, please fill the sheet under the guidance of teachers
2. The sheet is independent of academic record, private file, job arrangement and the total score of your exercise, please fill the sheet trustly
3. Please fill the sheet precisely

Gender age major grade

Questionnaire (5 minutes):

1. How long did you take to understand an independent clinical concept when in the course of dental education?
   1. After the whole lesson 2. During the lesson (after several description) 3. Immediately

2. Is there a difference of capacity of understanding between the two methods (The courses receiving noviclat after theoretic lessons and the courses combing noviclat and theoretic lessons)?
   1. Totally no 2. Fairly 3. Yes

3. Did you get better ability of learning during the dental noviclat compared to other departments?
   1. Totally no 2. Fairly 3. Yes

4. Do you feel satisfied with dental courses of teachers?
   1. Totally no 2. Fairly 3. Yes

5. What do you think of dental science depends on the quality of teaching after the courses?
   1. It’s just a subject 2. It’s a necessary subject of clinical science 3. I want to have a further developent in dentistry.

Figure 1. Questionnaire evaluating the effectiveness of clinical-based education method.

RESULTS

Test scores

Test scores followed a normal distribution. Overall equality of variances was demonstrated by the test of homogeneity of variance. Two means were analyzed by an independent T-test (Tables 1 and 2).

As shown in Table 1, the study group’s average score was slightly higher than that of the control group for the final examination. However, this difference was not statistically significant (P>0.05).

As shown in Table 2, both groups’ scores were lower when the students were tested one year later. The study


**Figure 2.** Questionnaire evaluating the effectiveness of clinical case database.

<table>
<thead>
<tr>
<th>Design standard: (GB101 sheet—J405)</th>
<th>Standard of application: PRC Adult</th>
</tr>
</thead>
<tbody>
<tr>
<td>Announcements:</td>
<td></td>
</tr>
<tr>
<td>1. The time filling the sheet is restricted, please fill the sheet under the guidance of teachers</td>
<td></td>
</tr>
<tr>
<td>2. The sheet is independent of academic record, private file, job arrangement and the total score of your exercitation, please fill the sheet truly</td>
<td></td>
</tr>
<tr>
<td>3. Please fill the sheet precisely</td>
<td></td>
</tr>
</tbody>
</table>

**Gender**

<table>
<thead>
<tr>
<th>age</th>
<th>major</th>
<th>grade</th>
</tr>
</thead>
</table>

**Questionnaire (5 minutes):**

1. Do you think the cases of clinical case database are representative?
   - 1 Totally no
   - 2 Fairly
   - 3 Yes

2. In the course of dental education, the clinical case database was used along with the clinical-based education method. Do you think it improves your learning of theories?
   - 1 Totally no
   - 2 Fairly
   - 3 Yes

3. If the application of clinical case database in the dental course stimulates your interest of study?
   - 1 Totally no
   - 2 Fairly
   - 3 Yes

4. In the course of dental education, the clinical case database was used along with the current clinical cases. Do you think it improves your study efficiency?
   - 1 Totally no
   - 2 Fairly
   - 3 Yes

5. In the course of dental education, the typical cases and intractable cases from clinical case database were applied. Do you think it stimulates your comprehensive clinical thought process?
   - 1 Totally no
   - 2 Fairly
   - 3 Yes

The group’s score was approximately 4.5 points higher than the control group’s score, but again this difference was not statistically significant.

**Result of questionnaires**

Overall variances of questionnaire replies were equal per homogeneity of variance tests. The independent T tests of averages are presented in Table 3.

The effectiveness of the new clinic-based dental education method

The results of the Questionnaire revealed that both teaching groups earned similar scores in the quality of teaching. The study group earned slightly higher scores
Table 1. Final exam scores of the class of 2005 medical students in Capital Medical University.

<table>
<thead>
<tr>
<th>Group</th>
<th>Number of students</th>
<th>Mean</th>
<th>Standard deviation</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clinic-based dental education method group</td>
<td>21</td>
<td>84.45</td>
<td>4.32</td>
<td>0.631</td>
</tr>
<tr>
<td>Traditional teaching group</td>
<td>22</td>
<td>83.77</td>
<td>4.85</td>
<td></td>
</tr>
</tbody>
</table>

Table 2. One-year follow-up examination scores of the class of 2005 medical students in Capital Medical University.

<table>
<thead>
<tr>
<th>Group</th>
<th>Number of students</th>
<th>Mean</th>
<th>Standard deviation</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clinic-based dental education method group</td>
<td>21</td>
<td>56.71</td>
<td>13.26</td>
<td>0.228</td>
</tr>
<tr>
<td>Traditional teaching group</td>
<td>20 (a)</td>
<td>52.23</td>
<td>10.03</td>
<td></td>
</tr>
</tbody>
</table>

[a]: Two students of traditional teaching group were absent from the tests because of sickness.

Table 3. Results of questionnaires filled out by the class of 2005 medical students in Capital Medical University.

<table>
<thead>
<tr>
<th>Item</th>
<th>Number of students</th>
<th>Mean</th>
<th>Standard deviation</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cognitive speed</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clinic-based</td>
<td>21</td>
<td>2.14</td>
<td>0.727</td>
<td>0.492</td>
</tr>
<tr>
<td>Traditional</td>
<td>22</td>
<td>2.00</td>
<td>0.617</td>
<td></td>
</tr>
<tr>
<td>Capacity of understanding</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clinic-based</td>
<td>21</td>
<td>2.29</td>
<td>0.561</td>
<td>0.485</td>
</tr>
<tr>
<td>Traditional</td>
<td>22</td>
<td>2.18</td>
<td>0.395</td>
<td></td>
</tr>
<tr>
<td>Ability of learning</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clinic-based</td>
<td>21</td>
<td>2.43</td>
<td>0.507</td>
<td>0.017a</td>
</tr>
<tr>
<td>Traditional</td>
<td>22</td>
<td>2.00</td>
<td>0.617</td>
<td></td>
</tr>
<tr>
<td>Level of satisfaction</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clinic-based</td>
<td>21</td>
<td>2.38</td>
<td>0.498</td>
<td>0.031a</td>
</tr>
<tr>
<td>Traditional</td>
<td>22</td>
<td>2.05</td>
<td>0.486</td>
<td></td>
</tr>
<tr>
<td>Quality of teaching</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clinic-based</td>
<td>21</td>
<td>1.95</td>
<td>0.218</td>
<td>0.982</td>
</tr>
<tr>
<td>Traditional</td>
<td>22</td>
<td>1.95</td>
<td>0.375</td>
<td></td>
</tr>
<tr>
<td>Overall score</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clinic-based</td>
<td>21</td>
<td>11.19</td>
<td>1.289</td>
<td>0.011a</td>
</tr>
<tr>
<td>Traditional</td>
<td>22</td>
<td>10.18</td>
<td>1.181</td>
<td></td>
</tr>
</tbody>
</table>

[a] indicates there is a statistically significant difference (P<0.05)

than did the control group in items of cognitive speed and capacity of understanding, but without a statistical significance (P>0.05). In items of the ability of learning, level of satisfaction and overall score, the new clinical-based teaching group received a significantly higher scores than did the traditional teaching group (P<0.05). more detailed information is shown in Figure 1.

The effectiveness of the clinical case database

To evaluate the effectiveness of the database of typical clinical cases, 184 questionnaires were distributed to medical students in the classes in 2007 and 2008. One-hundred and eighty-two valid questionnaires were returned, and two blank questionnaires were discarded from the study. The percentages of all answers were calculated.

The results of the Questionnaire revealed that more than 90% of students agreed that cases of clinical database were representative of real clinic cases, and more than 95% of students thought that they benefited greatly from learning the cases in the clinical database while studying theoretic knowledge. Students also claimed that they were more interested in learning dentistry than previously, and that
Table 4. Effectiveness of the database containing typical clinical cases.

<table>
<thead>
<tr>
<th>Items</th>
<th>Effective</th>
<th>Somewhat effective</th>
<th>Not effective</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>%</td>
<td>n</td>
</tr>
<tr>
<td>Representative of cases</td>
<td>165</td>
<td>90.66</td>
<td>15</td>
</tr>
<tr>
<td>Improved learning theories</td>
<td>173</td>
<td>95.05</td>
<td>9</td>
</tr>
<tr>
<td>Stimulated interests in study</td>
<td>179</td>
<td>98.35</td>
<td>3</td>
</tr>
<tr>
<td>Improved study efficiency</td>
<td>174</td>
<td>95.60</td>
<td>6</td>
</tr>
<tr>
<td>Stimulated comprehensive clinical thought process</td>
<td>172</td>
<td>94.51</td>
<td>10</td>
</tr>
</tbody>
</table>

their resulting learning process was more efficient. Approximately 94% of the students reported that study of typical cases helped them in developing a more comprehensive clinical thought process (Table 4).

**DISCUSSION**

Dentistry is an important component in medical college curriculum in China, as well as in many countries worldwide (Curtis et al., 1985; Sandhu, 2009). Despite the importance of this subject and the existing evidence of good initiatives in dental education in medical schools, the challenge persists as to how to make oral health training programs attractive and effective within the congested medical school curriculum.

Some studies have indicated that specific teaching programs in oral health promotion have elicited enthusiastic attitudes and positive interest from medical students (Gonsalves et al., 2004; Mouradian et al., 2006; de Sousa et al., 2011). Traditional dental education in medical schools in China begins with theoretic lessons followed by clinical observations, which causes students to gradually lose interest in dental topics. Furthermore, current dental education materials for medical students are simplified versions of dental students’ teaching materials, which fail to provide medical students with the breadth of knowledge that they require if they are to effectively treat and refer dental cases. These factors reduce the effectiveness of dental education for medical college students. A redesign of the current dental education program for medical students is therefore both important and necessary.

Based on our experience in providing dental education to medical students in Capital Medical University over the past eleven years, we have designed a clinic-based education method for medical students and have witnessed an encouraging result. The key features of this new clinic-based dental education for medical students include: (1) Far more graphics and video data added to increase efficiency. (2) Optimized study sequence: clinic-based cases studies integrated into the didactic teaching component, and (3) More focused, practical, and appealing new material that focuses more on typical clinical cases.

Psychological questionnaires showed that the study group had higher scores in aspects of cognitive speed, capacity of understanding, ability of learning, level of satisfaction and overall score. Among them, ability of learning, level of satisfaction and overall score showed a statistical significance. Based on these data, it can be concluded that effective combination of theoretic lessons and interactive clinical cases is a superior method of teaching dentistry to medical students.

Typical cases from the clinical database contain a vast amount of information concerning patients and diseases, leading to a lively presentation of particular diseases in real time. This new teaching method has been adopted in both medical and dental educations. After learning the clinical typical cases, students should be able to diagnose dental and oral health and systemic symptoms of dental illness, and should know the systematic treatment plans for particular diseases. The medical students receiving the course are interested in and appreciative of the process of learning from the cases, more than for the traditional teaching process. The database of clinical cases was welcomed by medical students.

The effect of education was evaluated by a quiz. The quiz questions composed by the instructors have a few problems. Most questions were composed subjectively, leading to an inadequate coverage of knowledge, and levels of difficulty could not be easily standardized. In this new clinic-based dental education system, a database of quiz questions was established in order to evaluate the learning ability of students and assess the effectiveness of education objectively. However, it is likely that test scores are not actually a good metric for evaluating the quality of learning, just like the condition of GRE (Miller and Stassun, 2014).

**LIMITATION OF THE STUDY**

The limitations of this study include relatively small sample size (forty-three students in the comparison study and one-hundred and eighty-four students in the study of the database) and relatively short follow-up time (one year). Future study should include more students and longer follow-up examinations.
CONCLUSIONS

A clinic-based dental education method is an education method that focuses on the learning of clinical problems with the support of databases of clinical cases and quizzes, concurrently with didactic lessons. Within the limitations of this study, a clinic-based dental education method was more effective than a traditional dental education method for medical students. Continuous standardization and refinement of the databases of the clinical cases and quizzes is needed to further improve the effectiveness.

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REFERENCES


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