Teaching Dental Pain With and Without Underlying Oral Physiology: Learning Implications


Abstract: This study investigated whether teaching undergraduate dental students the diagnosis and management of acute dental pain alongside the underpinning oral physiology helped them to understand the topic better than teaching them acute dental pain as a separate entity. Each of three clinical years of dental students at the same dental school was taught in two groups. Each group was taught the signs/symptoms of five acute dental pain conditions by the same member of the staff. However, the teaching for one group of students in each year reminded the students about the physiology that underpinned the clinical symptoms. One week later, the students completed an open-ended questionnaire that required them to list signs/symptoms of the five dental pain conditions. For each year of dental students that was examined, the mean student marks were significantly higher (p<0.05) for those who were taught dental pain and the underlying physiology compared with students who were only taught dental pain as a stand-alone subject. This suggests that integrating biomedical science and clinical teaching is beneficial.

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The undergraduate dental programs at many schools in the United Kingdom are undergoing curriculum revision alongside increases in student numbers. Traditionally, the first two years of dental school have been designed to provide students with a thorough understanding of basic sciences. As such, subjects such as anatomy and physiology were taught within a medical school setting by biomedical scientists at many dental schools or by basic science faculty members from a biomedical sciences school distinct from the dental school. The remaining two to three years, based at a dental school, concentrated on more clinically based subjects. However, many curricula are now being designed to bring clinical teaching forward into the earlier years, thus giving the opportunity to teach the relevant biomedical sciences alongside the corresponding clinical components.

These changes should prove to be advantageous as vertical integration between basic sciences and clinical medicine has been found to promote better understanding amongst medical students. In the past, most medical institutions have taught basic biomedical sciences separate and prior to the teaching of clinically related subjects. This lack of vertical integration within medical teaching can cause students to undervalue their basic scientific training; therefore, it is not surprising that first-year knowledge of basic sciences (such as physiology) is significantly lost over time amongst medical students.

It has been noted anecdotally by clinical staff that undergraduate dental students often find it difficult to diagnose acute dental pain in the accident and emergency unit. Diagnosing the causes of dental pain can be confusing for both undergraduates and clinicians. However, dental practitioners must carefully assess all patients who present with pain and reach a working diagnosis before performing irreversible treatment. Although a number of models have been designed to help diagnose pulpal pain, it is essential that students can go back to fundamental principles.
and use their knowledge of basic biomedical sciences to reach a clinical diagnosis. The hypothesis underlying the study reported in this article is that students who understand the physiology of a process should be able to apply this knowledge so that they can understand better the pathophysiology of the disease process.

At Bristol University in the United Kingdom, the physiology of dental pain has traditionally been taught prior to diagnosing and managing the clinical manifestations of toothache. This study aims to establish whether teaching the clinical signs, symptoms, and management of acute dental pain (vertically with the underlying trigeminal physiology) helps dental students to score a higher mark on a questionnaire testing dental pain compared to students who are taught dental pain as a stand-alone subject.

### Methods and Materials

Teaching in the clinical skills environment at Bristol Dental Hospital is delivered in half-year groups. During the 2008 academic year, both halves of the third-year students had an introduction to endodontontology. The first half was taught during the morning, whilst the second half was taught during the afternoon of the same day. During these sessions, students were taught the principles of diagnosing acute dental pain. The first half of the year (the morning group) received a PowerPoint presentation highlighting the classic clinical and/or radiological signs of dentinal sensitivity, an acute pulpitis, an acute apical periodontitis, a lateral periodontal abscess, and an acute dento-alveolar abscess. Treatment options for each of these conditions were also discussed, and the session lasted for fifteen minutes. The clinician who gave the presentation was one of the authors. He was trained in both physiology and dentistry at the bachelor’s degree level.

During the afternoon, the second half of the third-year students received the same PowerPoint presentation (from the same clinician who taught the morning group) with the addition of patient symptoms being explained in terms of revising the underlying neurophysiology. For instance, when a patient suffered from the “sharp shooting pain” of dentinal sensitivity, the students were taught that this was due to hydrodynamic fluid movement within the dentinal tubules activating the fast Aβ and Aδ pain fibers at the pulp-dentine junction. Patients with pulp/dentinal pathology are normally unable to localize the offending tooth. Although this was taught to all of the undergraduates, only the second group was informed that this was due to pulp and dentine containing very few proprioceptors. Both halves of the year were taught that patients with an acute apical periodontitis or lateral periodontal abscess tend to complain of a “continuous gnawing pain,” which they are able to localize to a specific tooth. However, only the second half of the year was told that these symptoms may be due to activation of the slower Aδ and C pain fibers within the periodontal ligament. The latter group of students was also informed that the periodontal ligament had a rich density of proprioceptors and that during periods of periapical infection/inflammation, these fibers are activated. Consequently, patients with periadicular pathology are more able to localize the offending teeth, an additional fact that was only revealed to the second group of students. Given that this group was also taught the underlying trigeminal physiology, the session lasted for twenty minutes.

One week later, the entire year of students was asked to complete an anonymous open-ended questionnaire on dental pain. The questionnaire asked students to list the signs, symptoms, and treatment options for different types of dental pain. It did not ask about the underlying oral physiology. Questions required two- to three-word answers, with each correct word scoring one mark. For example, one question was “List three features of the pain a patient with dentinal sensitivity would complain of.” A student listing the words “sharp shooting pain” would receive two marks. The maximum score that could be achieved by a student was 15. A model answer sheet was formulated after consultation with two specialists in endodontics and restorative dentistry. The responses listed in twenty-four randomly selected questionnaires were initially analyzed to see whether the model answer sheet required modification. There was good agreement between the students’ answers and the expected answers on the model answer sheet, so no modification was required. Candidates were given thirty minutes to answer the questions, but were not allowed to confer or refer to textbooks. The candidates were asked to not put their names on the answer sheets. Once the candidates had finished, the questionnaires were collected. They were subsequently marked by the same clinician who provided the lectures to both halves of the year. The examiner did not know which half of the year the scripts belonged to.

To ensure educational fairness, the first half of the third year was subsequently given the lecture...
on how to diagnose dental pain using basic tooth physiology (two weeks after they had completed the questionnaire).

The trial was then repeated (five weeks later) during the advanced endodontology course, and then two further weeks later during the restorative revision courses. This enabled collection of similar data from the fourth- and fifth-year students respectively.

Results

One hundred and forty-nine students were involved in this study and were assigned (by year) to two groups, 1 and 2. Students in group 1 received the lecture on diagnosing dental pain, whilst the students in group 2 received the lecture incorporating dental pain and oral physiology. The distribution of students according to year group and lecture content is shown in Table 1.

Completed questionnaires were analyzed for all participating students. The number of correctly answered questions was converted into a percentage for each questionnaire. The range of percentages that were scored across the three years of students varied from 40 to 100 percent. The percentages obtained for each group were then analyzed for skew and kurtosis. The data obtained from years 3 and 4 and group 2 of year 5 were normally distributed. The data from group 1 of year 5 were negatively skewed. The mean percentage scores for each group are shown in Figure 1.

Year 3 students in group 1 (who were taught the signs and symptoms of acute dental pain) scored a mean mark of 49 percent on the questionnaire, while Group 2 students from the same year (who were taught dental pain/oral physiology) scored a considerably higher mean mark of 74 percent. An unpaired, 1-tailed, student t-test confirmed that the mean mark from group 2 was significantly higher (p<0.05) than the mean score from group 1. Additional Mann-Whitney U tests suggested that the mean score from group 1 in year 5 was significantly higher (p<0.05) than the mean score of the group 1 students in year 3 (49 percent) but not significantly different (p>0.05) from the group 2 students in year 3 (74 percent).

Discussion

For each undergraduate year that was tested, students who were taught dental pain vertically integrated with the underlying physiology scored significantly higher on the questionnaire than the students who were taught dental pain as a stand-alone subject. The questionnaire only asked students to list signs, symptoms, and treatment options for different types of acute dental pain. It did not test any physiology. Year 3 students who were not taught any dental pain physiology scored a mean percentage score of 49 percent. Given that the year 3 students had limited clinical experience and had not encountered patients presenting with acute dental pain, this low score was not unexpected. Consequently, any student who had misunderstood the dental pain seminar struggled with the questionnaire. Year 3 students in group 2 scored a significantly higher mean mark of 74 percent. An unpaired, 1-tailed, student t-test confirmed that the mean mark from group 2 students was significantly higher (p<0.05).

In year 4, the mean percentage score from group 2 students (96 percent) was higher than that of group 1 (80 percent). Since the exam marks from both sets of students were normally distributed, an unpaired, 1-tailed, student t-test was carried out and confirmed that the mean mark from group 2 was significantly higher than from group 1 students (p<0.05).

Year 5 students in group 1 scored a mean mark of 75 percent; however, the fifth-year students in group 2 scored higher (95 percent). Given that the data from group 1 was negatively skewed, a Mann-Whitney U test was carried out and confirmed that the mean percentage score from group 2 was significantly higher (p<0.05) than the mean score from group 1. Additional Mann-Whitney U tests suggested that the mean score from group 1 in year 5 was significantly higher (p<0.05) than the mean score of the group 1 students in year 3 (49 percent) but not significantly different (p>0.05) from the group 2 students in year 3 (74 percent).

Table 1. Number of dental students in groups 1 and 2 by year

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of Students in Group 1 (lecture only on dental pain)</th>
<th>Number of Students in Group 2 (lecture on dental pain and physiology)</th>
</tr>
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<tbody>
<tr>
<td>3</td>
<td>33</td>
<td>35</td>
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<tr>
<td>4</td>
<td>22</td>
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a mean mark of 75 percent on the questionnaire. Final-year students should have encountered numerous dental pain patients (on accident and emergency rotations) and could have relied on clinical experience gained to answer the questionnaires. However, the final-year students who were taught dental pain/oral physiology did score higher (95 percent) than students who were only taught dental pain. This again may have been due to the comprehension of the principles of pain physiology by these students and their ability to apply these principles when answering the questionnaire.

Year 3 students in group 2 scored a mean mark of 74 percent. This was not significantly different from the year 5 students in group 1 who scored an equivalent mark of 75 percent. Although year 3 students in group 2 had not encountered patients with dental pain, perhaps the additional teaching that they received on pain physiology helped them to perform similarly to their year 5 counterparts on the questionnaire.

It could be postulated that a pathological process is more fully appreciated once a clinician has grasped the underlying physiology. Although this seems logical, few studies have looked for an association between basic science scores and clinical performance. Some U.S. trials have suggested that dental students who were taught clinical dentistry in symphony with the basic sciences scored significantly higher on the National Board Dental Examination Part I compared to students who were taught these subjects in isolation from one another. The results of our study—although much smaller in scope—certainly seem to be in agreement with this finding. Our students were tested only one week after receiving the physiologically elaborated lectures. In the short term, our trial seems to imply that vertical integration helps students to score a higher result on our questionnaire. However, this enhanced performance may not be maintained in the long term. Furthermore, there is no guarantee that the students in group 2 were any better at diagnosing dental pain in the accident and emergency clinic than the students in group 1. Further analysis with a similar questionnaire administered several months later would establish if knowledge is better retained long term by students who receive integrated teachings. If it were found that, in the long term, none of the students related physiology with clinical symptoms, there would be little point in vertically integrating the symptoms of dental pain with the underlying basic sciences. Given that very few prospective long-term trials have investigated whether vertically integrated teaching is efficacious in the long term, this is clearly an area for further investigation.

It has been assumed that the senior students had more clinical experience in managing patients with dental pain and that this accounted for the fifth-year students in group 1 scoring significantly higher marks than the third years in group 1. However,
given that the fifth-year students received the lectures and questionnaires on dental pain a few weeks after the third years, it is possible that the content of the physiologically elaborated lecture—and the fact that it would be examined—had been leaked to the more senior students. This is a major limitation of this trial as study groups are very common and knowledge is often shared amongst students. This certainly would have accounted for the difference in marks between the third-year students in group 1 and the corresponding group of fifth-year students. Even though it was possible that the fifth-year students knew they were going to be examined, the students (in group 2) who were taught the underlying physiology still managed to score a significantly higher mark than the students (in group 1) who were denied the basic scientific teaching. Perhaps an understanding of the oral physiology helped them to understand the principles of acute dental pain better than the students who were just taught orofacial pain as a stand-alone subject.

The students in this trial did not receive feedback on the questionnaire and were informed that it would not contribute to their assessments for the course. It is possible that a lack of motivation may have accounted for the poorer performance of some students. If the trial were to be repeated, students should be informed that they would receive feedback and the experiment should be designed to ensure that “cross-talk” of information is not possible amongst the different test groups.

Conclusion

Within the limitations of this study, it is concluded that vertical integration of oral physiology and clinical dentistry may have helped dental students to score significantly higher on a questionnaire testing dental pain compared to students who were only taught orofacial pain as a stand-alone subject. In the short term, this suggests that integrated biomedical science and clinical teaching is beneficial.

REFERENCES