Creating an Effective PBL Case in Oral and Maxillofacial Surgery at a Chinese Dental School: A Dental Education Primer


Abstract: Problem-based learning (PBL) is a widely accepted educational method centered on the discussion and learning that emerge from a clinically based problem; however, little has been reported on the details of PBL case-writing in the dental education literature. This article outlines some principles of writing a PBL case as it is practiced at a Chinese dental school and presents, as an example, an actual case based on a clinical problem (ameloblastoma of the jaw) intended to provide a learning focus for predoctoral dental students. A good PBL case should allow for progressive, interdependent actions to be taken in the evaluation and overall management of the patient in context and should trigger inquiry and discussion among students in both the basic sciences (anatomy, physiology, biochemistry, pharmacology, pathophysiology, etc.) and related clinical sciences. The epidemiological, sociological, and ethical considerations related to each problem should also be emphasized as an essential component of effective health care provision.

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Problem-based learning (PBL) was introduced at McMaster University in Canada in 1969, and in 1993, the World Medical Educational Summit in Edinburgh recommended PBL for use in medical schools around the world. Now a popular educational methodology in medical and dental schools worldwide, PBL is based on an educational format centered on the discussion and learning that emerge from a clinically based problem. As a student-centered means of learning that differs from traditional instructional methods, PBL focuses on active learning and self-directed student learning rather than a lecture delivered by the teacher. The PBL case can integrate basic science and related clinical science. In addition, PBL can motivate dental students to be more active in the classroom, encourage them to participate so as to gain knowledge as well as skills, and become highly qualified health professionals with the characteristics of cooperation, leadership, and an extensive knowledge of dentistry.¹²

There are three basic requirements for carrying out PBL: a small classroom with adequate facilities for about ten students, well-trained teachers or group leaders, and a number of cases that are regularly updated. High-quality PBL cases are one of the keys for successful PBL, but although PBL applications have been reported frequently in the English-language literature,³⁶ little has been reported on the details of PBL case-writing. For this article, we consulted the case model and teaching requirements of oral and
maxillofacial surgery and took a commonly seen odontogenic tumor (ameloblastoma) as an example to explain the requirements, contents, methods, and techniques of PBL case writing on a single subject.

Format and Design of a PBL Case

A PBL case can be divided into a number of tutorials depending on the teaching schedule. Cases should contain the following elements in their complete written form: 1) a title page is headed by the title of the case that identifies the core theme. The title page should also contain the case’s main purpose, and ideally the title or subtitle should be common, funny, and easy to memorize (such as “An Unpleasant Dinner”); 2) the first page contains instructions; 3) the second page includes the name, department, e-mail address, and phone number of the writer, along with the abstract and keywords of the case; 4) the third page should list the learning objectives, including the detailed objectives in medical science, clinical science, and behavioral science (the name of specific subjects must be listed); 5) the main part of the case consists of tutorials, each of which contains the content of the case, announcements to the teachers (the teaching purpose of the case), the main points of discussion, and questions for discussion; 6) a brief summary of the case, including number of credit hours; 7) a full summary; and 8) references.

Before designing a PBL case, the writer must first know the learning objectives and the knowledge to be mastered. Then he or she will start to search for an appropriate case and design the proper teaching material. A good case must be clear and focused, so that students can develop critical thinking through it. PBL cases for students should not be difficult to diagnose, but they should be representative so that students can acquire general knowledge through self-learning. Each case should be compatible with the general teaching goals and should keep pace with the students’ educational progress.

A PBL case should be divided into four to six scenarios based on modified real clinical cases and according to a line of logical reasoning. It should be designed for completion within four hours. Some virtual elements can be added to illustrate the case.

The story behind the case should be designed as an inverted triangle, moving from less information to more. The first scenario, which is usually considered the key part of the case, begins with the chief complaint of the patient; this provides multiple directions for students to think critically. Then, the information should be disclosed progressively in order to gradually narrow the boundaries, so the students can find the potential problems in the case, discuss proper ways to solve those problems, and fulfill the teaching objectives. A case should include the chief complaint, the patient’s history and examination, testing results, the treatment plan, and prognosis and progress.

A complete PBL case in its written form should have two parts: the tutor guide and the student guide. The student guide includes the scenarios only, while the tutor guide contains the complete title, preface, scenarios, discussion guidelines, and references. The scenarios presented in the case should be presented in narrative form in a way that guides students to think and discuss its elements in various ways.

Example of an Oral and Maxillofacial Surgery Case

This section presents the basic elements of an actual PBL case in oral and maxillofacial surgery as an example.

Tutorial 1

Case description: You are a first-year attending dentist in the Oral and Maxillofacial Surgery Department in 3G Hospital. One morning, a twenty-two-year-old man named Zhang comes in with the chief complaint of swelling in his right cheek. He says that he has had a swollen cheek for about half a year and has pain in the posterior teeth as well. He used to see a dentist at the local hospital but was not given any special treatment. He used to use antibiotics himself (the name and dose of the drug are unknown), which relieved the pain temporarily. He had felt his right cheek swelling and teeth aching again one month ago, and the local hospital gave him some pain pills. Recently, he felt numbness in his lower lip, so he came to our hospital for further treatment.

Notes for teachers: Guide students in discussing the basic dental science, clinical dental science, and behavioral and sociological aspects of the symptom of a swollen cheek.

Main discussion points: 1) Reasons for the swelling, pain in the cheek, and related diseases. 2) Possible reasons why the patient did not get treatment earlier.
Questions for discussion: 1) What disease do you think it is (at least four possibilities)? 2) Which do you think is the most likely disease according to his symptoms? Why? 3) What examinations and history do you need to make a proper diagnosis? 4) Where do you consider the standard of care received at the local hospital to be, according to his experiences?

**Tutorial 2: First Scenario**

The physical examinations after admission showed the following: temperature 36.0 degrees Celsius; heart rate 70 bpm; respiratory rate 18 breaths per minute; blood pressure 140/80 mmHg (right upper arm). No other positive signs were found.

Liver function test: Total protein: 63 g/L. Albumin: 32 g/L. The test results were normal. Tests for hepatitis B, antibody for hepatitis A, and hepatitis E were negative, and other parameters of liver function were normal.

Flood fasting glucose: 6.6 mmol/L. Tests for syphilis (TRUST) and HIV were negative.

Special physical examination showed that the patient has a bilateral asymmetry in the face with an obvious swelling in the right buccal region and a hard mass of 4.5 cm x 4.0 cm with clear boundaries. Poor activity and mild tenderness to touch were found. No teeth were missing in his mouth, and the mouth opening was about two fingers wide with a normal opening type. No enlarged lymph nodes were found in the submandibular and neck region. The initial diagnosis is mass in right mandibular region with infection.

Notes for teachers: In this section, use laboratory examinations and special physical examinations to limit the lesion in the area of mass in mandible. The teacher can guide the students to think: Why was it diagnosed as “mass in the right mandible with infection”? How many kinds of masses occur in the mandible, and what are their clinical features? What further examinations should be done to validate the diagnosis?

Main discussion points: 1) The main features on panoramic films and CT films of this patient; 2) Differential diagnosis and features from imaging examinations.

Questions for discussion: 1) Which diagnosis can be excluded according to the examinations above? 2) Which disease is the most likely? Which evidence can support your diagnosis? What is your evidence anatomically, pathologically, and physiologically? 3) What further examination results and information do you need to make sure of the diagnosis?

**Tutorial 2: Second Scenario**

The patient was given imaging examinations after admission. The panoramic radiograph (picture given to students) showed that there are multi-cystic areas with a decrease in bone density and clear boundaries in the right side of the body and the mandibular ramus. The third molar is located in the lesion region with a formed root, while the teeth above the lesion have a saw-shaped root absorption. The mass has an obvious expansion downward. The third upper molar on the right side was impacted vertically. A CT scan (cross section, soft tissue window and coronal section, and bone window pictures are given to students) shows there is a multi-cystic lesion with low density in the right mandible, and it is clearly expanded both buccally and lingually. The cortex of the mandible has become thinner and discontinuous in some sections, but the soft tissue around the lesion is not violated.

Notes for teachers: Guide students to do a differential diagnosis between a mandibular cyst and an ameloblastoma according to the imaging experiments and to discuss a proper treatment plan according to the area of the lesion.

Main discussion points: 1) The main features on panoramic films and CT films of this patient; 2) Differential diagnosis and features from imaging examinations.

Questions for discussion: 1) What’s the most likely diagnosis for Zhang according to his history and examinations? 2) What’s the feature of this disease in imaging examinations? 3) What should the dentist do next?

**Tutorial 3**

After being examined thoroughly in the hospital, Zhang underwent an operation for resection of the mass in the right mandible and reconstruction with vascularized iliac bone graft and immediate implantation. The operation resected the affected bone in the right mandible, including the coronoid process and muscle attachments. An iliac bone flap from the right side was taken and fixed with a reconstructed titanium plate. Next, an anastomosis was done between the iliac artery, the facial artery and the iliac vein, and the branch of the internal jugular vein. Two Straumann implants were planted in the iliac bone. The operation was completed successfully. The pa-
thology report shows that it was ameloblastoma with infection and fibroplasia.

After the operation was complete, infusion, anti-infection, and nutrition support was given. Zhang recovered and was discharged uneventfully. During a follow-up appointment he said he feels well but is worried about recurrence.

Notes for teachers: This part provides the treatment plan and pathological appearance after the operation. Considering the complexity of pathological appearances and treatment plans, the teacher should guide the students in focusing on the following problems: How should doctors treat ameloblastoma in the mandible, and how do they reconstruct the mandible after the resection procedure? What are the classifications and pathological features of ameloblastoma? Why is recurrence common in ameloblastoma, and what is the basis for recurrence histologically and pathologically? How can doctors prevent recurrence, and how can they explain the risk of recurrence to the patient?

Main discussion points: 1) The principles behind and indications of the operation; 2) The histological and pathological type and appearance of the lesion; 3) The clinical biological behavior and prognosis of ameloblastoma.

Questions for discussion: 1) How do we treat ameloblastoma in the mandible? 2) How many pathological classifications does ameloblastoma in the mandible have? What are their features? 3) What are the clinical biological behavior and prognosis of ameloblastoma? How do doctors answer questions the patient is worrying about? 4) What should we learn from the patient’s experience of treating history in local hospitals?

Tutorial 4

Fourteen questions were listed in the case, and the main issue is the following: how many lesions in a mandible can be taken into consideration? Through the process of elimination, we finally focused on the cause, clinical and pathological appearance, imaging appearance, treatment plans, and prognosis of ameloblastoma. These discussion topics helped students gain a complete understanding of the diagnosis of a mass in the mandible, especially ameloblastoma, and let students learn from the perspectives of medical ethics, health economics, health laws, health policies, and doctor-patient communication.

Main points to summarize: Summarize the key points of each part or each scenario. Integrate and fuse clinical medicine and humanities, and list the pathogenic mechanisms according to the causes and results (shown in diagrams or videos).

Tutorial 5

Related literature can be given to the students as references according to the teaching goals, including books, journal articles, and electronic databases.

Discussion

PBL is a group discussion and learning educational method organized by tutors around a case. There are three roles for the teacher: the resource provider, the evaluator, and the facilitator. This approach centered on the discussion and learning that emerge from a clinically based problem motivates students to conduct a discussion themselves. The basic model is case→problems→self-learning→discussion→summary. High-quality cases are key for successful PBL teaching. Because of the critical role cases play in PBL, the cases must be well designed and of high quality, and 20 to 30 percent of them should be reviewed and revised each semester to keep them up-to-date.

The area that a PBL case involves is wide, including such subjects as 1) human biology in both health and sickness, including anatomy, physiology, pathology, radiology, internal medicine, and surgery; 2) professional skills such as diagnostics, problem-solving, communication, and clinical management; 3) public health, medical service, economics, and public policy; and 4) medical ethics and professional attitude. PBL cases can also raise such topics as doctor-patient relations, doctor-society relations, and doctor-staff relations. The discussion of PBL cases helps students to handle such relationships when they become dentists as well as managing a disease using molecular and cellular science, organs, tissues, systems, the human body, family, and society. It also requires cooperation between educators in different professions and subjects.

The use of PBL cases improves the analytical and problem-solving abilities of students through the use of information given step by step. The PBL process also encourages students to define problems and test hypotheses through discussion, gain unforgettable, problem-solving-based knowledge by looking into the literature, and develop self-learning and teamwork. In an informal convenience study at
our dental school, between April 2007 and March 2008, PBL was conducted (eight cases were used) with thirty-eight fifth-year dental students during their core clerkship at the Department of Oral and Maxillofacial Surgery. Compared with forty fifth-year dental students who completed the traditional teaching program between April 2006 and March 2007, the faculty found that the students in the PBL group demonstrated significantly better abilities in face-to-face spoken tests, case analysis, and clinical skills. In addition, students in the PBL group considered PBL to be more interesting, more effective, more cooperative, and more beneficial to their future medical career.

Based on our experience with PBL cases, we believe the following are critical factors in the writing of a PBL case (Figure 1):

1. Each case must have a clear goal and subject as its focus. Cases should be created based on clinical problems to encourage students to think about their related knowledge in such areas as anatomy, physiology, pharmacology, biochemistry, and pathophysiology. Good PBL cases also encourage students to consider elements of the scenario related to clinical knowledge, epidemiology, social medicine, and ethics.10

2. The content of the scenarios should be based on real clinical cases, but need not adhere to them rigidly. The case can be redesigned and rearranged like a reverse triangle. Social and professional skills should also be taken into consideration.

3. Information should be given gradually in the case. It usually begins with a history of present illness, past history, family history, social conditions, and systematic review; then gradually gives physical examination findings, laboratory results, imaging findings, and the diagnosis; and finally, treatment. Each part contains lots of questions and “ifs” to promote student discussions. Through the gradual process of elimination,

![Figure 1. Flowchart demonstrating the process of writing a PBL case](image-url)
students identify, explore, discuss, and finally complete the learning objectives.

4. The case should not be designed as a retrospective case for discussion. Rather, the design of each scenario should put students in the position of a real dentist facing a patient and let them feel the case as it is developing. The contents should not be written as a case report but like a story. Visuals such as operative procedures, ultrasonic pictures, radiographs, CTs, MRIs, histopathological results, and EKGs should be provided. Cases involving basic medicine should not contain too much exact data, examinations, diagnosis method, or detailed treatment plans. They should not ignore the main goals just to hide the final answer, and the answer should not be given too early, which would allow students to ignore other goals.

5. Problems and important points contained in the scenario should be listed in the tutor’s guide, so that tutors (who may not be experts) can lead student discussion by questioning them to meet the teaching goal.¹¹

6. A case review conference should be held by the relevant department after each draft is done. The content should be modified by experts in that area, the members of the review conference, and the writer of the case. After several rounds of editing, checking, and confirming, the final case can be use in PBL teaching. It should subsequently be revised according to any problems detected in the teaching process until it is satisfactory.

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