Original Article

Case-based learning: A study to ascertain the effectiveness in enhancing the knowledge among interns of an Indian dental institute

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Abstract

Objective: Time and again, it has been shown that active learning promotes critical thinking, and this environment has to be fostered in dental education too. Therefore, the present study was carried out with an aim to know the effectiveness of case-based learning (CBL) in enhancing the knowledge of dental interns of a dental institute in India.

Materials and Methods: This pre-post single-blinded, experimental study was conducted in two sessions on a purposive sample of 45 dental interns who gave informed consent. The interns answered a pretest questionnaire comprising questions related to their knowledge of hyperplastic tissue in complete denture patients. The interns were randomly allocated into three subgroups for thorough discussion. Each group viewed all three parts of a case related to hyperplastic tissue and presented the case in the presence of a facilitator. The facilitator discussed the subject with the three subgroups. A post-test was conducted immediately, and the results were compared with the pretest. The facilitator explained about hyperplastic tissue with an audio-visual aid after the post-test was administered. The perception of interns toward CBL was assessed by a standard questionnaire.

Results: On analysis, the comparison of the overall knowledge scores pre- and post-CBL showed a statistically significant increase from 9.8 ± 2.14 to 12.6 ± 1.37 ($P < 0.001$).

Conclusion: CBL proved to be effective in enhancing the knowledge of dental interns.

Key Words: Case-based learning, hyperplastic tissue, problem-based learning, prosthodontics, small group teaching

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Received: 02nd April, 2016, **Accepted:** 05th August, 2016

INTRODUCTION

The traditional mode of teaching is the didactic lecture format. Although it may be effective in imparting a large amount of information to a large number of students, it leads to a passive form of learning and is teacher-centered.[1-3] Passive learning

Access this article online	
Quick Response Code:	Website: www.j-ips.org
	DOI: 10.4103/0972-4052.194945

How to cite this article: Shigli K, Aswini YB, Fulari D, Sankeshwari B, Huddar D, Vikneshan M. Case-based learning: A study to ascertain the effectiveness in enhancing the knowledge among interns of an Indian dental institute. J Indian Prosthodont Soc 2017;17:29-34.

does not incorporate student interactions and focuses on only exposing students to predetermined study material.[3] Learning can be better achieved with student-centered active learning which allows the students to interact with each other and the instructor via discussions, questions, etc.[4] Active learning strategies are defined as "instructional activities involving students in doing things and simultaneously thinking about what they are doing."[5] This can be done by including problem-based learning (PBL), case-based learning (CBL), team-based learning, and peer-assisted learning.[1] Major and Palmer note a benefit shared by PBL and CBL: "Students who acquired knowledge in the context of solving problems have been shown to be more likely to use it spontaneously to solve new problems than individuals who acquire the same information under more traditional methods of learning facts and concepts through lectures."[6]

Although PBL and CBL share common goals, each instructional design possesses unique characteristics.[7,8] PBL requires no prior knowledge in the subject whereas CBL requires students to have a degree of prior knowledge that can aid in solving the problem.[7] PBL is student-driven whereas CBL is a collaborative endeavor, in which the faculty member is more intimately involved in the learning.[9]

CBL is an interactive, student-centered, instructor-led learning approach, and it was first applied in medical education by the anatomy department of a medical school in Newfoundland, Canada.[1] CBL promotes active learning using case scenarios to mimic real-life instances which the student may encounter in future.[1,2,9] Cases are generally shown as problems to provide the student with a complete background and the clinical situation of the patient.[1,7,10] Cases act as a stimulus and motivate the learner to critically think and gain knowledge in the presence of a facilitator.[11] CBL promotes a deep-learning approach with active and meaningful learning.[12,13] It enables students to see the direct relevance and logical direction of the information to be learned for their goal of clinical practice so that they are more likely to remember such information.[12] CBL facilitates the development of reflective thinking and deeper understanding.[12,13]

The advantages of CBL are that it disseminates new information and supplements existing knowledge; allows students to develop a collaborative, team-based approach; and fosters learning by providing vertical and horizontal integration of the syllabus. It also aids in building relationships and learning through an enjoyable activity.[7,9,10,14,15]

Dental schools in many countries have reported difficulties in finding suitable undergraduate teaching material, with fewer complete denture cases treated by students before graduation. In the future, clinicians may not be sufficiently equipped to diagnose and plan treatment for edentulous patients.[16] Students' clinical experience can be enhanced by exposing them to a variety of cases. Case-based scenarios could aid in clinical decision-making.[10,17]

In India, 5 years curriculum is followed, wherein the last year is compulsory rotary internship. All the students are expected to integrate the subject learned in 4 years and put in practice. Knowledge acquired by listening to lectures during their course may leave the interns with difficulty to imply in practice.

CBL requires the students to have a certain level of prior knowledge that can assist in solving the problem, and since interns had previous final year knowledge, this study was carried out with an aim to know the effectiveness of CBL in enhancing the knowledge of dental interns in Bharati Vidyapeeth Dental College and Hospital, Sangli, India.

The objectives of the study were to compare the knowledge of dental interns related to hyperplastic tissue in complete denture patients pre- and post-CBL and to evaluate the perception of the dental interns with CBL.

MATERIALS AND METHODS

This was a pre-post single-blinded, experimental study. Ethical clearance was obtained from the institute to conduct the study.

Subject of the study

Hyperplastic tissue in complete denture patients was chosen as the learning subject. In the undergraduate curriculum, the management of edentulous patients is covered. Hyperplastic tissue is a common occurrence with the prolonged usage of dentures and hence, the dental students should be aware of it.[18]

Sampling

A purposive sample of all interns ($n = 64$) (both boys and girls) in Bharati Vidyapeeth Deemed University Dental College and Hospital, Sangli, India, was considered for the study. Interns who were present on the day of recruitment, who had completed the prosthodontic posting with almost similar clinical cases in internship, and who gave informed consent were selected for the study. Forty-five dental interns fulfilled our inclusion criteria and were recruited for the study.

Study instrument

a. The investigators identified five domains related to hyperplastic tissue in complete denture situations, which was necessary for an undergraduate curriculum. The questionnaire comprised 19 multiple choice questions with four choices for each question with only one correct answer. These items were divided

into five domains (flabby tissue, denture stomatitis, combination syndrome, denture irritation hyperplasia, and management). In each domain, subtopics were identified by two investigators (DH and DT) based on relevance and were included in the questionnaire after a consensus. The reliability of the questionnaire was checked on two separate events (0.78).

The content validity was analyzed[19] by taking the opinions of 15 subject experts. If any question had a content validity ratio of <0.49, the question was deemed as inadequate and was deleted after consultation with the experts. After the validity assessment, out of the 19 multiple choice questions, 16 were retained and three were deleted. The modified questionnaire comprised 16 multiple choice questions. It was further divided into five domains - flabby tissue (4 questions), denture stomatitis (5 questions), combination syndrome (3 questions), denture irritation hyperplasia (2 questions), and management (2 questions). This questionnaire was used as pre- and post-knowledge assessment measure (outcome measure)

b. A standard questionnaire was used to assess the perception of interns with CBL.[15]

Study procedure

The study was conducted in two sessions. A facilitator who was blinded to the groups explained the basic concepts and detailed process of CBL. Since the interns previously had knowledge regarding hyperplasia, they were asked to answer a pretest questionnaire comprising questions related to their knowledge of hyperplastic tissue in complete denture patients. This study was conducted in two time periods, wherein the first phase interns were randomly allocated into three subgroups of seven each for thorough discussion. In the second phase, eight interns of three groups were divided. Each group could view the entire case scenario, but the outcomes were divided among three groups. Each group worked on their own part, and at the end, all the three groups presented their findings to the facilitator. This presentation was performed by a group leader. The facilitator discussed the subject with the three subgroups. The case scenario and the questions are shown in Appendix 1.

A post-test was conducted immediately with the same knowledge questions, and the results were compared with the pretest. The facilitator at the end of the session gave an explanation about hyperplastic tissue with an audio-visual aid after the post-test was administered. In addition, the facilitator clarified any doubt and got a feedback from the students related to the application of CBL. The data were entered in the excel sheet and analyzed using the Statistical Package for the Social Sciences version 19.0 (Armonk, NY: IBM Corp).

RESULTS

A total of 45 interns were recruited for the study. There were two dropouts in the study, so the sample size considered for statistical analysis was 43.

The respondents were 15 (33.3%) males and 30 (66.7%) females with a mean age of 22.54 ± 0.83 years.

Comparison of the overall pre- and post-mean CBL knowledge scores showed an increase from 9.8 ± 2.14 to 12.6 ± 1.37, which was statistically significant with $P < 0.001$ using Wilcoxon signed-rank test [Table 1].

The increase in correct percentage was calculated by subtracting from the pre-CBL session. When the domain-wise scores were analyzed (flabby tissue, denture stomatitis, combination syndrome, denture irritation hyperplasia, and management), there was an improvement in all domains except denture irritation hyperplasia where a marginal decrease in the scores was observed which was −1.16 ± 1.64. The highest increase in scores was observed in the domain related to combination syndrome which was 34.88 ± 6.58. The scores related to the management domain were found to be 8.13 ± 21.37 [Table 2].

The response of the interns related to their perception to CBL showed that more than 80% of the interns strongly agreed, and they also agreed that CBL stimulates study interest, helps understand basic concepts, promotes communication with students, facilitates to solve clinical problems, and extends more related knowledge. Approximately, 80% of the interns agreed (both "strongly agree" and "agree" category) that CBL enlightens students during interaction with tutor, promotes

Table 1: Comparison of mean knowledge score before and after case-based learning

	Mean	*n*	SD	Mean difference	*Z*	*P*	Significance
Prescore	9.84	43	2.137	−2.767	−5.189	<0.001*	S
Postscore	12.60	43	1.365				

Wilcoxon signed-rank test; $P \leq 0.05$, statistically significant; $P > 0.05$, nonsignificant. SD: Standard deviation, S: Statistically significant, NS: Nonsignificant

Table 2: Distribution of change in the mean scores according to different domains

Domains	Average increase - domain wise	SD
Flabby tissue	20.93	12.95
Denture stomatitis	23.83	13.74
Combination syndrome	34.88	6.58
Denture irritation hyperplasia	−1.16	1.64
Management	8.13	21.37
Overall increase	18.61	14.47

SD: Standard deviation

self-learning, improves the arrangement of prosthodontic curriculum, and helps to find out key points [Table 3].

DISCUSSION

The traditional lecture mode of teaching is teacher-dominated and leads to one-way transmission of information. Student-centered education has recently been introduced in India, and the effectiveness of such method needs to be tested, especially for the Indian scenario. There are few studies on student's acceptance for this new method of learning. Only three studies could be traced in literature related to CBL in prosthodontics in India. The present discussion has not included the two studies as they had used computer software to impart teaching. Hence, the present study was carried out with an aim to know the effectiveness of CBL in enhancing the knowledge of dental interns in Bharati Vidyapeeth Dental College and Hospital, Sangli, India. The study group was interns as they are in between the thin line of cross-over to general practice and are preparing themselves to deal with patients more effectively. The 3rd and 4th year students are also having exposure to this topic covered for the study, but the lack of experience and tighter schedule of curriculum in these years refrained them to be a part of the study.

Although the past academic performance of the study participants was not considered, their performance in clinics in the department of prosthodontics was used as the criterion for taking these interns. The number of cases performed by these interns was almost similar; however, more objective assessment criteria should have been productive. As CBL is effective only for small group teachings, only 45 interns were recruited for the study. The facilitator was a subject expert with training in CBL method of teaching and hence calibration was not deemed necessary. Moreover, students were not sensitized to such learning.

Table 3: Distribution of students according to the responses to the satisfaction questions

Items	*n* (%)		
	Strongly agree	Agree	Neutral
Stimulate study interest	36 (85.7)	6 (14.3)	
Help to understand basic concepts	34 (81)	8 (18.6)	
Extend more related knowledge	32 (71.1)	9 (20.9)	2 (4.7)
Help to find out key point	27 (64.3)	12 (28.6)	3 (7)
Promote self-learning	29 (69)	11 (26.2)	2 (4.8)
Promote communication with students	33 (78.6)	9 (21.4)	
Enlighten students during interaction with tutor	30 (69.8)	10 (23.3)	2 (4.8)
Facilitate to solve clinical problems	33 (78.6)	9 (21.4)	
Improve arrangement of prosthodontic curriculum	28 (66.7)	11 (26.2)	3 (7.1)
Expand in more teaching procedure of Prosthodontics	29 (69.0)	12 (28.6)	1 (2.4)

The present study dealt with a single content area (hyperplasia) delivered in one dental institute in India. Hyperplasia was chosen as the topic for CBL to test students' application of knowledge regarding the choice of impression material and the impression technique to be employed in such situations.

In the present study, the knowledge scores showed an improvement post-CBL in all domains except one. A study by Gali *et al*.[20] concluded that case-oriented small group discussions are effective to help students correlate the science of dental materials into clinical application. The results of the present study are in agreement with those of Du *et al*.[15] who found that CBL was more effective than lecture-based education (LBE) to teach dental students as the test scores of the CBL group were significantly higher than those of the LBE group. They suggested that CBL should be added in the future curriculum for dental students. The results of the present study are also in line with those of McKenzie[14] according to whom the case-based education course was found to have positively affected students' knowledge.

When the response of the interns related to their perception to CBL was analyzed, most of the interns perceived CBL to stimulate study interest, help understand basic concept, promote communication with students, extend more related knowledge, enlighten students during interaction with tutor, and facilitate to solve clinical problem. The positive perception of interns could be due to exposure for the first time of a newer teaching method having a supportive and informal environment which encourages students to give their inputs and ideas along with more time spent on individual cases which may not be feasible in clinics. The results of the present study are consistent with those of Zhang *et al*.[21] who concluded that CBL is an effective method to improve students' clinical reasoning, diagnosis, and logic thinking. Chan *et al*.[22] reported that CBL improved communication through group discussion.

CBL depends on both construction of cases and facilitators' skill.[14,15] There is a wide diversity reported in the literature according to the speciality, type of cases, number and length of exposure to cases, and definition of the cases in case-based studies.[12] The intervention duration reported varied from two hours for one case to CBL for 1 year.[12] Most of the literatures documented are in the field of medicine.[12] Ciraj *et al*.[10] indicated that CBL sessions enhanced active learning in microbiology. According to Nair *et al*.,[11] CBL is effective for better understanding of biochemistry among medical students. Although CBL has been a concept which is well developed and practiced in medical curriculum, the evidence showing the use of CBL in prosthodontics in India is scant.

CBL stimulates students' interest, so it can be easily incorporated as an aid in effective evidence-based education system and in turn evidence-based clinical practice. In India, we stress "Critical thinking" at a postgraduate level. If we incorporate it at the undergraduate level, it would contribute to better understanding. Studies have shown that CBL may be a good adjunct to traditional lectures.[9,10] CBL can also be used for early clinical exposure. Implementation of CBL phase wise in the curriculum can be considered by the professional bodies. Orientation and training programs should be conducted for the faculty to sensitize and implement different teaching approaches to stimulate higher order thinking among the learners in prosthodontics.[10]

CONCLUSION

This study was an initial step in evaluating the effectiveness of CBL in prosthodontics. CBL proved to be effective in enhancing the knowledge of dental interns. The interns had a positive response to the use of CBL as teaching method. At the time of clinical postings, CBL can be incorporated as this would facilitate learning at a higher level.

Acknowledgments

The authors would like to acknowledge Dr. Gunnar Carlsson, Dr. K Chandrasekharan Nair, Dr. Satish Babu, Dr. Gopichander, Dr. Suresh Sajjan, and Dr. Raghavendra Adaki for their inputs in the questionnaire. The authors thank Dr. Aniruddha Varekar for help in conducting the study. We acknowledge the guidance of Dr. Avinash Supe, Dr. Medha Joshi, Dr. Jyoti Nagmoti, Dr. Poornima Kadagad, Dr. Sunila Sangappa, Dr. Sarmishtha Ghosh, Dr. Sivapathasundharam, Dr. N.S. Azhagarasan, and Dr. Mahesh Verma. We acknowledge the help rendered by Dr. Neha Agrawal for statistical analysis. We thank Dr. Sunil Nayak for completing the patient treatment.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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APPENDIX

Appendix I: "Case record and questions" planned related to "Hyperplasia"

Part I: A 66-year-old female patient reported to the Department of Prosthodontics with a chief complaint of a growth in the lower front region. The growth was painful and had grown slowly over a period of 5–6 months. She gave a history of using the complete denture for 3 years, which had been impinging in the same region.

Clinical examination revealed nontranslucent, mobile, and soft-to-firm, sessile mass in the mandibular anterior lingual region in contact with the denture border. The lesion extended 5–6 mm mesiodistally and 3–4 mm superioinferiorly. The overlying mucosa was erythematous. There were no other similar lesions in the oral cavity. Examination of the mandibular denture revealed an overextended anterior lingual denture border.

Question: What could be the reason for the lesion?

What is the provisional diagnosis?

Part II: Management of this patient

Question: What will be your instructions to the patient?

Part III: Preventive measures

Question: What care should be taken at the time of denture insertion?