



# Case-based Virtual Seminars on Masticatory Muscle Disorders during the COVID-19 Pandemic

Sivaranjani Gali<sup>1</sup>

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## Abstract

Due to the significant influence of COVID-19 pandemic on dental education in the recent past, interactive educational strategies were explored to engage students. Case-based seminars (CBS) were proposed on masticatory muscle disorders (MMDs) for post-graduate dental students through integration of pathophysiology with its etiology, diagnosis, and management. Effectiveness of CBS was done at Kirkpatrick's level 1 and level 2 hierarchy with a pre-test and a post-test. CBS enhanced learning outcomes of post-graduate students in understanding MMDs. Thus, this report could serve as a useful model for other dental schools in prosthodontic post-graduate curriculum.

**Keywords** Dentistry · Temporomandibular joint · Masticatory muscles · Masticatory muscle disorders · Case-based seminars · COVID-19 pandemic

## Background

Seminars are a form of teaching–learning strategy, with small groups of students discussing and focusing on a specific subject, in which all participants are encouraged to interact. The post-graduate curriculum for 3 years in our dental school follows a module-based system, split into six modules (each of 6 months) ranging from pre-clinical work, removable prosthodontics, fixed prosthodontics to full mouth rehabilitations. One of the learning outcomes of the running module, consisting of tooth supported fixed prosthodontics and temporomandibular joints (TMJ), is that students must be able to diagnose TMJ disorders for multidisciplinary management. Traditional seminars for complex topics turn into more of a theoretical relevance with less clinical application and are less appealing as too much information on a topic is being presented with no perspective of associated clinical relevance. With this academic gap, case-based learning (CBL) was explored as a solution during the novel SAR-CoV-2 (COVID-19) pandemic.

CBL was introduced as a pedagogical method aimed to connect anatomy-physiology with clinical sciences. With patient-centered learning outcomes being encouraged in dentistry, case-based discussion imparts relevant learning, promotes interest among students, and supports the desired learning outcomes of dental students. CBL is essentially built on structured and guided inquiry-based learning with a constructivist approach to learning with knowledge being acquired in a stepwise series of group interactions. This CBL learning process nurtures a deep approach, where students change from acquiring and reproducing knowledge, to pursuing meaning through the application of knowledge as they see things in a different way. CBL offers advantages to students of being exposed to clinical cases and provides opportunities for formulating diagnosis, management, and treatment, to understand the underlying mechanism of basic science and prepares them for clinical practice. CBL provides a holistic picture of anatomy-physiology, etiology, clinical diagnosis, and management instead of separate views, as seen in traditional methods [1, 2].

The learning theories of CBL derive from adult learning, inquiry-based and deep learning approaches that encourages active and meaningful learning [3]. CBL enables students to understand the relevance and rational course of the information for clinical practice. Such approach can be highly motivating and students are more likely to retain cognitive information. It also empowers reflective thinking and theoretical

✉ Sivaranjani Gali  
nature79gali@gmail.com; sivaranjanigali.pr.ds@msruas.ac.in

<sup>1</sup> Department of Prosthodontics, Faculty of Dental Sciences, M.S. Ramaiah University of Applied Sciences, MSRIT POST, 560054 Bangalore, Karnataka, India

understanding [4–7]. Case-based learning has been implemented in several disciplines of medical and dental health profession educations. Multidisciplinary case-based seminar (CBS) series were implemented for senior dental students for clinical decision making and were found to be effective in achieving learning outcomes [8].

With several academic advantages of case-based learning, the intent of online or virtual CBS during the COVID-19 pandemic was to integrate the selected dental topic or theme of masticatory muscle disorders (MMDs) through case reports with a perspective of linking neuromuscular anatomy and physiology of masticatory muscles with etiology, diagnosis, and clinical management.

## Activity

With a prior knowledge on anatomy-physiology of masticatory muscles, a group of three second year post-graduate students worked with the faculty moderator in presenting a case-based seminar (CBS) on masticatory muscle disorders (MMDs). Case reports on various muscle disorders were engaged from the recommended resource book for post-graduates, Okeson's Management of temporomandibular disorders and occlusion [9]. Each of the case reports of MMDs, for example, protective co-contraction, was further classified based on the reported case's neuromuscular anatomy-physiology-clinical manifestations-treatment and assigned to each of the three post-graduates as a group seminar. The case reports were used as a template to explain related neuromuscular mechanisms, occurrence of specific clinical signs and symptoms, disease etiology, diagnosis and management of patients behind the case presentation. It required several brainstorming discussions of moderator with the student to organize the contents for PowerPoint Presentations. PowerPoint Seminars were presented virtually online for the scheduled time slot of 1 h 15 min. A total of six case reports with two seminars slots were required for MMDs. Tables 1 and 2 present the outline and content of CBS for MMDs. To verify the effectiveness of case-based seminar, a pre-test and a post-test on masticatory muscle disorders (based

on the contents) were administered to other postgraduates before and after the seminar, respectively. Few cases of MMDs were engaged from the recommended resource book for post-graduates, Okeson's Management of Temporomandibular Disorders and Occlusion were modified and described in the following sections [9]. This case engagement from the prescribed book reflects a gap of lack of clinical records and the important need to document out-patient cases of MMDs reporting to the Department. Enhancement of knowledge and learning outcomes were evaluated at reaction (level 1) and learning levels (level 2) of Kirkpatrick's hierarchy through pre-tests, post-tests, and student feedback. Pre-tests and post-tests were structured based on the contents in the PowerPoint presentations. Questions in the tests were designed as recall multiple-choice questions and were conducted using Google Forms. The students were revealed their scores immediately after the respective tests. Statistical Package for Social Sciences (SPSS, Windows Version 22.0, 2013, Armonk, NY: IBM Corp) was used to perform statistical analysis. Descriptive analysis included expression of study parameters in terms of mean and standard deviation for test scores. Kolmogorov-Smirnov test was used for testing the normality of data. Paired Student's *t* test was used for comparing the pre-test and post-test scores. The level of significance was set at  $p < 0.05$ .

## Results

Case-based seminar (CBS) on masticatory muscle disorders was presented to 11 other post-graduates in the Dept of Prosthodontics, belonging to fresher year ( $n = 4$ ), second year ( $n = 2$ ), and final year post-graduates ( $n = 5$ ). A statistically significant difference ( $p < 0.00001$ ) was observed between the pre-test and post-test scores. We found 58.3% of students strongly agreed CBS have advantages of relating clinical cases to anatomy and neuromuscular physiology of masticatory muscle disorders; 66.7% of students strongly agreed they are helpful in understanding masticatory muscle disorders better; 50% strongly agreed CBS helps in better formulation of diagnosis in masticatory muscle disorders; 58.3% agreed

**Table 1** General outline of case-based seminar on MMDs

Topic	Sub-topics	Integrating disciplines	Student name
Masticatory muscle disorders (Okeson's Temporomandibular disorders, 8th edition)	•Protective co-contraction	•Pain Pathway and muscle physiology	Post-graduate 1 (PG1)
	•Local myalgia	•Clinical diagnosis	Post-graduate 2 (PG2)
	•Myofascial pain	•Clinical management	Post-graduate 3 (PG3)
	•Acute myospasm		
	•Centrally mediated myalgia		
	•Fibromyalgia		

**Table 2** Contents of case-based seminar**Description of Case Report 1**

A 40-year-old salesman walked to the dental office complaining of left masseter and temporalis pain that had been present for 2 days and had begun shortly after a composite restoration was placed in his right maxillary first molar. The pain was increased with jaw use and almost eliminated by simply not moving his mouth.<sup>12</sup>

This case of protective co-contraction was discussed based on the following:

- Basic science of pathophysiology of protective co-contraction to neuromuscular mechanism of antagonist muscle activity and myotatic reflex (presented by post-graduate 1)
- Etiology related to altered pain input such as high point on a recent restoration, deep pain input and emotional stress
- Muscle examination procedures and clinical features such as reduced range of jaw movement with pain, no pain at rest with muscle weakness through examination of muscles, TMJ and Occlusion (presented by post-graduate 2)
- Management consisting of restricted jaw movements for healing, soft diet, NSAIDS for pain with Physical Self-Regulation Techniques (presented by post-graduate 3)

**Description of Case Report 2**

A 20-year-old female college student came to the dental office complaining of a generalized muscle soreness of the right side of her face. The pain was increased with chewing and had been present for about a week. She revealed that this type of pain had been present on three other occasions, 3, 6, and 8 months ago. She did not report any noticeable change in her occlusion, but felt that the pain did restrict her mouth opening. Further questioning revealed that each of the three episodes of pain, as well as this episode, was associated with her college examinations.<sup>12</sup> This case of local myalgia was discussed based on the following:

- Basic science of pathophysiology of prolonged protective co-contraction and its etiology related to deep pain input and emotional stress (presented by post-graduate 1, 25 min)
- Muscle examination procedures, maximum inter-incisal distance and presenting clinical features such as reduced range of jaw movement with pain, no pain at rest with muscle weakness through examination of muscles, TMJ and Occlusion (presented by post-graduate 2, 25 min)
- Management consisting of restricted jaw movements for healing, soft diet, NSAIDS for pain with Physical Self-Regulation Techniques and Stabilization Appliance (presented by post-graduate 3, 25 min).

they help in deriving information on required investigations for MMDs; 58.3% agreed CBS can prepare for better clinical practice and management of TMJ disorders; and 50% of them strongly agreed to recommend CBS in Prosthodontics for complex topics in future. Feedback from students and faculty are presented in Table 3.

**Discussion**

The present study indicates that CBS enhanced learning outcomes of post-graduate students in understanding MMDs. Students and faculty responded with feedback on CBS. The findings are coherent with positive reports on the effectiveness of CBL in health professional education at level 1 and level 2 of CBL's outcome evaluation. Development of CBS

required intensive, in-depth discussions by the faculty moderator with the post-graduates. CBS was conducted during the lockdown due to the second wave of COVID-19 in the city of Bangalore, India. With clinical departments being shut down at the University, the lockdown period gave a good opportunity for post-graduates and a worthy time for the faculty moderator to reflect and prepare for online seminars. As mentioned in Activity section, group seminar on MMDs was presented as a team, with each student presenting a clinical case and discussing on its anatomy, neuromuscular physiology, pathophysiology, etiology; clinical diagnosis, required investigations; and its clinical management. Implementation of CBS such as collating the slides of students and organizing them required good effort and patience from faculty moderator and students. However, the deliberations paved way to discovering and connecting the dots of basic and clinical science to better

**Table 3** Feedback of students and faculty on CBS**Student comments were as follows**

“Improved the learning objectives through better understanding”

“Very useful and innovative”

“We need case discussion for full mouth rehabilitation”

“Nice and interesting way of presenting seminars”

“It was a good attempt”

“Good method for better understanding”

“Felt that it requires more time to prepare. So, during regular college days it might be difficult for the student”

“Case based learning really helped in gaining knowledge about everything regarding each disorder, from the origin, etiology, diagnosis and management together. Great way to put things together for both learning and remembering”

“Was very helpful in understanding the topic”

**Suggestions to improve case-based seminars from students were as follows:**

“Video/ animation demonstration on muscle palpation”

“Use of such seminars should be done for other topics as well. Department cases can be used to make it more relatable”

“If they tell differential diagnosis and other treatment plan it will more useful for our cases”

“To have a discussion or a question at the end of seminar on a different case, to know how well we have understood the topic and also as a test to ourselves”

“More of flowchart of pictures”

“Flow can be improved”

“May be the real cases that the we come across may be discussed and compared to the literature available”

“Difficult topics like FMR can also be learnt this way”

“Could use different case scenarios commonly encountered in the practice”

**Faculty comments were as follows:**

“Well presented seminar”

“Refreshing seminar”

“Seminar was presented in a different and interesting way”

“We can try to adopt the case-based model to difficult topics”

understand the complex nature of TMJ disorders including MMDs. This understanding was evident in the students and the faculty appreciating the CBS format as mentioned in the “Results” section of this study. The learning evaluation was done at lower levels of Kirkpatrick’s hierarchy. Higher levels of application of knowledge through clinical skills could be further evaluated through clinical observations and chair side assessments. One of the students commented that CBS required more time to prepare and therefore, during regular college days, it might be difficult for the student to prepare extensively due to busy clinical schedule. Hence, CBS will be a good seminar model tool for virtual online learning that could be adopted during the COVID-19 pandemic. CBS can be a seminar model for other dental schools and universities to adopt and teach complex topics, linking basic and clinical sciences in prosthodontic post-graduate curriculum. Dental

Council of India and the Health Universities across the country recommend and follow seminars as a teaching–learning method in the post-graduate prosthodontic curriculum. Educational policies at health universities must provide a leeway of freedom for academic leaders to innovate, customize, and change teaching–learning and assessment strategies. Such academic reflections will help design a dynamic and an outcome-based curriculum to prepare future health professionals for relevant societal needs.

**Declarations**

**Conflict of Interest** NA.

**Ethical Approval** Yes.

**Informed Consent** Yes

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