Complexity of comprehensive care treatments in undergraduate dental programs: The benefits of observing and assisting experienced faculty members

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Abstract
Objective: To improve the confidence of the final year dental students in completing occlusal and oral rehabilitation of patients, with complexities beyond their scope, based on full analysis of the biomechanical and esthetic considerations of each case.

Material & methods: Two comprehensive patient situations presenting with special difficulties including extensive, reduced vertical dimension of occlusion, limited interocclusal space and maxillary alveolar bone for implant insertion necessitating bone augmentation and a sinus lift surgery was managed by two students at our institute. Procedures like surgical crown lengthening, sinus lifting, and bone augmentation were performed by senior faculty with the respective two students’ assisting as well as following up at the healing phase and reporting progress of healing and any possible complications to the supervisor. Students’ reported significant improvement in decision making skills; time management; interpersonal skills, management of cases in an evidence –based
Interdisciplinary approach as well as increase in their confidence in managing complex cases independently. Follow up with both cases showed optimum outcome and patients' satisfaction.

Results: Students' reported significant improvement in decision making skills; time management; interpersonal skills, management of cases in an evidence-based interdisciplinary approach as well as increase in their confidence in managing complex cases independently. Follow up with both cases showed optimum outcome and patients' satisfaction.

Conclusions: Exposing students to manage complex oral rehabilitation including procedures like sinus lifting and bone augmentation, through an evidence-based interdisciplinary approach during the undergraduate comprehensive clinical dentistry course enhances their confidence and clinical acumen as an independent practitioner.

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1. Introduction

The Comprehensive Clinical Dentistry (CCD) course at the College of Dentistry (CODA), University of Dammam, was created to expand the different professional skills and clinical experiences of undergraduate students. The patient situations presented in the CCD course target sixth-year students to diagnose and treatment plan patient situations with diverse oral and dental health problems. Students are required to make a formal power point presentation and then discuss and defend their treatment plans (an ideal plan and alternative plans) using an evidence-based multidisciplinary patient-centered approach. Many dental schools around the world include a similar type of course with a greater number of credit hours than other courses in their undergraduate dental curriculum (Johnson, 1999; CODA, 2012).

At COD the comprehensive care treatment planning places the patient at the center of all dental treatment considerations after factoring in the status of their medical and dental health conditions. Once a final treatment plan has been approved each CCD student is responsible for presenting his comprehensive assessment and recommended treatment plan to the patient along with alternative treatment options (Nulty et al., 2010). Improvement in students' confidence and a reduction in overconfidence both have been cited as positive outcomes of experience and feedback during clinical courses with close supervision (Kruger and Dunning, 1999).

The CCD course provides students with sufficient time to execute the most suitable treatment plan for each particular patient in an effort to assure optimum quality oral and dental health care leading to patient's welfare and satisfaction. This is in line with the new Accreditation Standards for Dental Education Programs by the Commission on Dental Accreditation (CODA) standards (CODA, 2012).

By the end of CCD course students acquire a greater understanding of multidisciplinary treatment planning and patient management. Each student is required to complete three comprehensive cases categorized according to their degree of difficulty into one of three categories: simple, moderate, or advanced. For the purpose of augmenting the clinical experiences of students, some clinical procedures beyond the scope of a general dental practitioner are performed by senior clinical faculty members with the assistance of the dental student to give them an exposure in planning a comprehensive treatment plan for patients presenting with varying degree of complexities in the oral health condition. The CCD course director must approve all cases and proposed treatment plans, as well as any subsequent changes or modifications. The CCD clinical faculty monitors the progress of the planned treatments, discusses, evaluates and records the performance of each student in formative and summative assessment schemes outlined in the course specification, which are shared with the students at the beginning of the course.

The attached reports represent two of the advanced complex cases managed by two undergraduate students during the CCD course. The presented cases constitute biomechanical, esthetic as well as time management challenges to an undergraduate student in the CCD course. All the clinical procedures that were beyond the scope of general dentistry practice, such as a sinus lift and surgical implant placement, were performed by senior clinical faculty members, while the students served as assistants, provided follow up care, and reported the patient’s progress to their respective clinical instructors. The two students, participating in the management of these cases, were “A” grade students certified for their exceptional clinical skills, competencies and commitment towards patient care in previous clinical courses. Their participation in the management of these two cases was an opportunity for them, as competent students, to treat cases beyond the general dental practice in close supervision with senior staff members.

Feedback from all students, including the two students who participated in the management of the two cases, was solicited through an online Student Satisfaction Survey. This was conducted to determine the effectiveness of exposing students to complex cases beyond the scope of general dental practice as well as to improve the course requirements based on student’s feedback.

2. Clinical report

2.1. Case 1

A 35-year old male patient came to the dental clinic with a chief complaint of “I want to fix my broken posterior teeth.” The patient lost his teeth 10 years ago and did not provide specific information on their loss. Medical and dental histories
were taken using printed questionnaire and though direct questioning by the students.

2.1.1. Medical history
The patient was medically fit with no history of serious hospitalizations and reported no known allergies or medications use.

2.1.2. Dental history and clinical examination
All data, previous dental treatment experiences were collected. Extra and intraoral examinations were performed, clinical and radiographic findings were recorded in the patients’ paper file as well as in the intranet digital patients recording and archiving system in accordance with the college’s policies and regulations. The patient had poor oral hygiene, reported infrequent tooth brushing or flossing, endodontic treatment on teeth #3 14 months ago and #18 approximately 10 years ago. There was clinical and radiographic evidence of multiple remaining roots in the areas of teeth #1, 3, 4, 17, 19, 20, 30 and 31.

Extraoral examination showed normal facial symmetry with a straight profile, non-palpable lymph nodes. TMJ was not tender to palpation and the maximum mouth opening was 47 mm.

Intraoral examination revealed many remaining roots (teeth #1, 3, 4, 17, 19, 20, 30, 32), carious tooth #14: recurrent caries, incomplete root canal treatment (RCT), supra-erupted, overhanging restoration. Tooth #13 was super erupted and teeth #15, 16, 29 and 31 had occlusal and proximal carious lesions as indicated by the clinical examination and bitewing radiographs.

2.1.3. Periodontal diagnosis
Probing depths ranged from 1.0 to 7.0 mm (7.0 mm between teeth #14 and #15). CAL (Clinical attachment loss) was 4.0 mm, and the O’Leary Plaque Index was 39%. The periodontal diagnosis showed generalized plaque induced gingivitis and localized moderate chronic periodontitis. Employing the American Dental Association (ADA) assessment chart, the patient was determined to have a high caries risk with infrequently teeth brushing, no flossing, high sugar diet, visible plaque, active caries and multiple previous restorations.

2.1.4. Prosthodontic diagnosis
Maxillary partially edentulous arch was classified as a Kennedy Class II, modification 1 while the mandibular arch was classified as a Kennedy Class III, modification 1. The patient’s casts were mounted on a semi-adjustable articulator (Hanau™ Modular Articulator, Whip Mix Corp., Louisville, USA) using a Whip-Mix face-bow record and an interocclusal record that was made with the aid of a Lucia jig and polyvinylsiloxane occlusal registration material (EXABITE II, GC Corp., Tokyo, Japan). The condylar settings were adjusted using the jaw relation records.

2.1.5. Treatment plan
i. Phase I (control phase): Patient education and oral hygiene instructions, supra and sub-gingival scaling, root planing, polishing and topical fluoride application were performed on all remaining teeth. Caries excavation and for caries control, glass ionomer restorations were placed on teeth #29 and #31.

ii. Re-evaluation: After four weeks, the patient was re-evaluated to assess pocket depths, gingival inflammation, plaque and calculus scores. A level of good oral hygiene was reached with an O’Leary plaque index of 10% facilitating the progress to the surgical phase of treatment plan. In addition, dental caries was re-evaluated using a Diagnodent device (KaVo, Biberach, Germany) that indicated no new further carious lesions.

iii. Phase II (Surgical Phase): The following procedures were performed: extraction of teeth #1, 3, 4, 17, 19, 20, 30, and 32, pocket elimination and crown lengthening surgery using an apically displaced flap for tooth #14, endodontic treatment of tooth #15 (rotary PROFILE system and X-Smart, Dentsply Maillefer Int., Ballaigues, Switzerland), endodontic retreatment of tooth #14 (rotary PROFILE system, Ballaigues, Switzerland), intentional endodontic treatment and crown lengthening of tooth #13, gingivectomy and implants’ insertion replacing teeth #3, #4, #19, #20, and #30 (Friadent XiVE, Dentsply, Friadent GmbH, Mannheim, Germany).

Preliminary cone beam computed tomography (CBCT) analysis was conducted following healing of the extraction sockets for planning the implants’ insertion. The sinus lift surgery in the area of #3 and #4 was performed using the indirect osteotomy technique with implant length and diameter for #3 was 5.5 × 11, for #4 was 3.8 × 11, and using bone graft (Bio-Oss cancellous bone, Geistlich Sohne AG, Wollhusen, Switzerland) prior to the implant placement. The implants and bone grafts were covered with a BioMend® Extend™ 20 × 30 mm absorbable collagen membrane (Zimmer Dental, Warsaw, Indiana, USA) and one week postoperative periapical radiographs were recorded.

A second surgery was performed four months after the initial surgery to expose the implants replacing teeth #3 and #4 and placing the healing abutments. A definitive impression was made after three weeks of healing. Friadent XiVE (Dentsply) implants replacing teeth #19, #20, and #30 (#19 was 5.5 × 11 mm, #20 was 3.8 × 11 mm, #30 was 5.5 × 11 mm) were placed using a minimally invasive surgical technique (flapless surgery). Bone graft (poros-cortico-cancellous particulate Allograft (Zimmer Dental, Warsaw, Indiana, USA) used in the area of teeth #19 and #20) covered by a BioMend 15 × 20 mm membrane (Zimmer Dental, Warsaw, Indiana, USA). After a subsequent waiting period of 6 months, healing abutments were connected to the implants, and the prosthetic procedures were performed. All the definitive crowns were screw retained.

iv. Phase III (Definitive Phase): Composite restorations were placed in teeth #8, #16 and #29, an amalgam restoration for tooth #31, #3 single metal-ceramic crowns for #13, #14, #15 and the final restoration for implants #3, 4, 19, 20, 30 were screw retained metal-ceramic crowns.

v. Phase IV (Maintenance Phase): The patient was seen at one month, 3 months and 6 months post final restoration insertion, during internship program using history, clinical and radiographic examinations.
2.2. Case 2

A 47-year-old female patient came to our clinic with the chief complaint: “I want to fix my front teeth”. The medical history showed she was medically fit and well.

2.2.1. Dental history and clinical examination

The dental history indicated that the patient had received scaling one year ago and root canal treatment for teeth #18 and #19 two years ago. Extraoral examination revealed that no significant asymmetry existed, and the lymph nodes, TMJ and salivary glands were normal. The maximum mouth opening was 42 mm. Intraoral examination revealed multiple missing teeth, carious teeth, loss of posterior support and a history of parafunctional habit (bruxism) with extensive occlusal wear.

2.2.2. Periodontal diagnosis

The probing depth ranged from 1 to 3, rounded margin and blunt papillae, supragingival deposition of calculus, plaque index was 38% and bleeding on probing was 22%. The periodontal diagnosis was generalized chronic plaque induced gingivitis.

The patient had a high caries risk, high sugar diet, visible plaque, active caries and multiple previous restorations. Occlusal analysis demonstrated that contact on anterior teeth only in centric occlusion, molar relationship could not be determined, occlusal guidance: anterior guidance on protrusive movements with extensive wear and reduced vertical dimension of occlusion (VDO).

In addition, prosthetic diagnosis was Class II modification I on the maxillary arch after extraction of tooth #2. Class III on mandibular arch and non-hygienic metal ceramic bridge with open margins.

2.2.3. Treatment plan

i. Phase I: Patient education and oral hygiene instructions, scaling and root planning, caries excavation and caries control restoration (glass ionomer) on teeth #20 and 21, removal of non-hygienic metal ceramic bridge (4 × 6) and replace it with a provisional one, fabrication of an occlusal splint for one month with follow up of patient adaptation to the new VDO which perfectly adapted without muscle tenderness and TMJ discomfort.

Occlusal splint fabrication: The patient had a straight facial profile and with signs of loss of vertical dimension of occlusion, the freeway space was 5 mm. Maxillary and mandibular anterior teeth demonstrated an excessive amount of space during the “S” sound pronunciation (Silverman, 1953; Turrell, 1972; Turner and Missirlian, 1984). The incisal edge position was lost due to attrition of the maxillary anterior teeth. The diagnostic casts were made and mounted on Hanau H2 articulator using a tentative CR record at the proposed VDO using physiologic rest position and confirmed by esthetics and phonetics. The patient’s casts were mounted on a semi-adjustable articulator (Hanau™ Modular Articulator; Whip Mix Corp., Louisville, USA) using a face-bow record and an interocclusal record that was made with the aid of a Lucia jig and polyvinylsiloxane occlusal registration material (EXABITE II; GC Corp., Tokyo, Japan). An acrylic occlusal splint was fabricated on the articulator at the-proposed VDO in CR (Conti et al., 2012; Okeson, 1988). A diagnostic mock-up was made for the maxillary anterior teeth to determine the restored incisal edge position using phonetics and esthetics. Diagnostic waxing was then carried out at the proposed occlusal vertical dimension. Thus, an appropriate occlusal plane and canine guidance occlusion were established.

ii. Re-evaluation: Similar to case 1, after one month, the patient was re-evaluated to assess the pocket depths, gingival inflammation, plaque and calculus scores as well as caries.

iii. Phase II: Extraction of tooth #2 and endodontic retreatment of teeth #14, 18, 19 were performed. Then preliminary CBCT analysis was conducted for planning the implants’ insertion. Extraction of tooth #11 was followed by immediate implant insertion. More implants were placed for teeth #2, 3 and 13 (Friadent XIVE, Dentsply) in a procedure that included sinus lifting using the indirect ostectomy technique for teeth #2 and #3 and bone grafting Bio-Oss Spongious bone substitute small granules 0.25–1 mm (Geistlich Sohne AG, Wolhusen, Switzerland) and BioMend 15 × 20 mm membrane (Zimmer Dental, Warsaw, Indiana, USA).

iv. Phase III: The following procedures were conducted: composite restorations for teeth #20 and #21, post and core using fiber post for teeth #18, 19 and 31 and cast post and core for tooth #14, single complete veneered metal-ceramic crowns for teeth #7, 8, 9, 10, 14, 18 and 19, two single complete veneered metal-ceramic crowns (cement retained restoration for implants #2 and #3 in addition to a three-unit fixed supported prosthesis for (11 × 13), three-units metal ceramic bridges (4 × 6) and (29 × 31) and the fabrication of an occlusal night guard appliance.

Complete veneered metal ceramic crowns and bridges were used as final restorations for the posterior teeth as the patient insisted to have superior esthetic quality. A full arch resin splint was fabricated and the patient was instructed to wear it during sleeping every night, as well as in day times during stress situations.

v. Phase IV: One month after final insertion of the restoration, the patient was seen for an observation. Then, at three and six months during the internship program using history, clinical and radiographic examinations.

2.3. Case management summary

Senior Faculty performed sinus lifting and implant insertion procedures. The rest of procedures were performed by the student with a remote supervision by senior staff members as representative of all clinical disciplines.

Students assisted in sinus lifting and implant insertion procedures and performed all other management procedures according to the treatment plan.

Patient satisfaction survey showed that both the patients were satisfied with the treatment they received. Patients addressed the professionalism in attitude and commitment of the treating student as well as the adequate communication skills and active listening showed throughout the management phase. The availability of senior staff members during the different phases has increased the patient feeling of confidence and appreciation.
3. Discussion

Exposing students at the clinical level of the dental program to a variety of cases across various clinical specialties enhances their clinical experiences and augments their clinical skills and decision making abilities. Implementing evidence-based and patient-centered clinical practices in comprehensive clinical dentistry assures optimum standards of oral and dental health care based on biomechanical and esthetic rationalism for complete patient satisfaction and welfare.

At the beginning of the CCD course and following patients allocation and referral policies of the college, each student selects three respective comprehensive cases as simple, moderate and advanced following the criteria of case selection described in CCD course specification so that prosthodontics is a fundamental part of the proposed treatment in addition to two different clinical disciplines. Similar to other programs, completing the assigned three comprehensive cases, in addition to the minimum requirements of 160 points, is mandatory for passing the CCD course (Park et al., 2011).

In a study performed by Vining (1984) comprehensive care is defined as “a system of clinical operations and instructions which permits students to be responsible for all aspects of a given patient’s treatment needs in a manner that closely resembles the way the student will provide care in private practice subsequent to graduation”. Several schools have implemented unique and innovative programs in comprehensive care. In a study by Dodge et al. (1993), the authors determined the effect of a clinical program driven by patient needs upon students’ productivity, attitudes, and academic performance. Their results suggest that the clinical programs can maintain quality and productivity in the absence of unit requirements. Stacey et al. (1998) reported that there was no significant difference between the productivity of the two groups of the final year undergraduate; one with numerical clinical targets and one without any numerical targets. In addition, Holmes et al. (2000), described the effect of removing the minimum requirement on students’ productivity and competence. Their results have suggested that the amount of clinical work done were less than the minimum requirement groups. The clinical requirements in our study are essential to provide the students with a target at the end of their course encouraging them to carry out different clinical procedures and to provide an indication of an individual student’s practical experience. Moreover, the mandatory requirement of completing three comprehensive cases in our CCD course provides the students with an opportunity to improve their clinical performance as well as demonstrate professionalism in providing comprehensive patient care using an evidence-based interdisciplinary approach.

After detailed history taking, clinical examination and initially approving the case for comprehensive care by the assigned CCD faculty, detailed diagnostic procedures and any needed emergency treatments are performed. Each student designs the most appropriate treatment plan for each respective comprehensive case, presents and discusses it with the supervising committee of different clinical specialties in an evidence-based approach supporting the decision of providing specific managements. At each phase of the treatment plan the progress of the management is discussed with the course director and each clinical procedure is evaluated by the respective clinical instructor as a daily clinical evaluation.

The presented cases were treated following the planned schedule over a period of seven months. Time management is a basic skill and is quite evident in extensive cases like the two cases of the current report. Careful selection of certain cases to fall within the indication of each specific clinical procedure or treatment option and to suit the course duration and expected performance of respective students is a principle measure in assuring optimum prognosis.

In the reported cases, all the procedures were performed by the students except for the implants’ insertion, sinus lifting, bone augmentation and surgical crown lengthening that were performed by a senior periodontist with the respective student assistance and observation as well as following up at the healing phase and reporting progress of healing and any possible complications to the periodontist supervisor. Exposure to these complex procedures provided a diverse clinical experience and helped improve the decision making ability as reported by 79% of the students. The experiences of following referral policies in situations beyond general dental practice, time management, interpersonal and communication skills have been markedly augmented as reported by 90% of the students. This was also evident during the final cases report presentations made by the students, at the end of the course, which was assessed by invited external examiners from local and international dental colleges with encouraging and positive feedback on students’ confidence and clinical acumen.

Exposing students to modern diagnostic tools like the cone beam computed tomography scanning was reported by 36% students to have increased their decision making skills. Confidence in managing challenging cases independently during internship was also reported to have increased by 67% students.

However, 73% of the students suggested keeping management of complex cases as an optional requirement versus making it a mandatory requirement keeping in mind the time required to complete such cases may extend beyond the course timelines making it difficult for students to complete the requirement.

4. Conclusion

Challenges of the clinical situations our CCD students are exposed to are even more than the kind of complex cases managed by undergraduate dental students globally. Exposing students with proficient skills and excellent performance to more extensive clinical experiences beyond the scope of general dental practice enhances their comprehensive patient management skills including knowledge, cognitive, psychomotor, interpersonal and communication skills. Follow up with the presented cases showed optimum outcome and complete patients’ satisfaction. Evaluation of treatment outcomes, prognosis and patients reaction to evidence-based, patient-centered practice through timely scheduled follow ups in these cases constitute a solid base for optimum quality oral and dental health care services.

Declaration

Ethical Permission for the study was obtained by the authors through the Institutional Review Board at the University of Dammam.

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Conflict of interest

We have no conflict of interest to declare.

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