

A Comparison of Continuous Clinical Assessment and Summative Clinical Assessment in Restorative Dentistry

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SUMMARY

A possible measure of clinical competency for undergraduates may be students' continuous clinical assessment marks. This study compared each student's continuous clinical assessment (CCA) mark with their summative clinical assessments (SCA) in Paedodontics, Crown and Bridgework, Endodontics and Basic Restorative Dentistry. This was done in order to evaluate the predictive potential of the former against the latter, more conventional measure of assessment. The criterion to determine clinical competence was 60% and any assessment achieved above this would imply clinical competency. Comparisons were made between CCA and SCA for the 39 BChD V undergraduates in the disciplines of Crown and Bridgework, Paedodontics and Endodontics, as well as for the 59 BChD IV undergraduates in the discipline of Basic Restorative Dentistry, for the 2004 academic year. Data were analysed using a two-sample t-test and were also subjected to a Spearman Rank Order Correlation test. For the BChD V students, differences between the two assessment measures were significant for Crown and Bridgework ($p=0.00$) and Endodontics ($p=0.03$), but not so for Paedodontics ($p=0.22$). For the BChD IV students the difference between CCA and SCA for Basic Restorative Dentistry ($p=0.00$) was significant. The Spearman test produced

generally weak correlation values ($p<0.4$), while the average assessment for Crown and Bridgework for the BChD V group of $<60\%$ suggests that, on the basis of the results of this study, continuous clinical assessment cannot be used as a predictor of clinical competence in this discipline.

INTRODUCTION

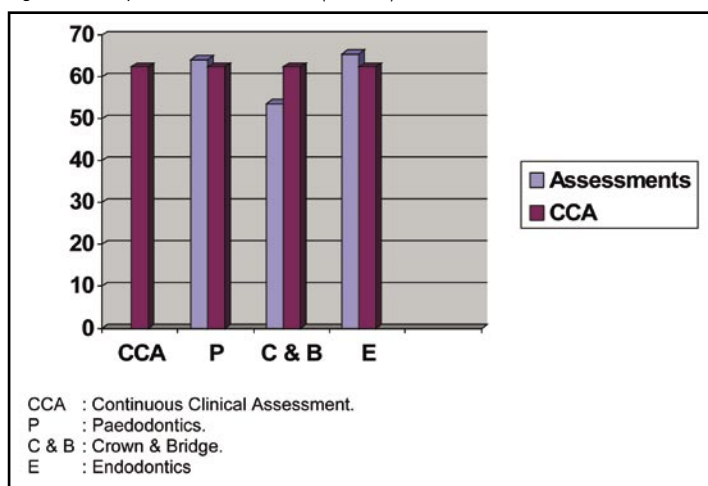
The objective of a competency or outcomes-based education programme is to ensure that an individual has the necessary skills, understanding, professional values and knowledge to do something successfully¹⁻³. This has led to many dental academic institutions internationally adopting a competencybased clinical curriculum that focuses more on desired learning outcomes^{1,4-9}. The need to develop more consistent methods of assessment to evaluate clinical competency has been well documented^{3,6,7}. Many of the methods of assessment that have been described in the literature^{2,8,10-14}, are not appropriate for assessing clinical competency of dental procedures performed by students. Dental schools need to ensure that they produce dentists who are genuinely competent. Continuous clinical assessment is an important component in a competency-based dental curriculum⁸.

The Department of Restorative Dentistry at the School of Dentistry in Pretoria has adopted a competency-

based assessment system that is both formative and summative, using criteria that aim to reflect the organization, preparation, communication, clinical, and managerial skills in all aspects of dental procedures performed by undergraduates during clinical sessions. This competency-based assessment system was developed by adapting six levels of competency described in the literature^{3,8,14,15} and allocating a clear, explicit and unambiguous criterion to each level of competency. Each level of competency was given a score. The students use the criteria on the assessment form to self-assess their level of competence accordingly, while the supervisor's assessment is used to control the student's assessment using the same criteria.

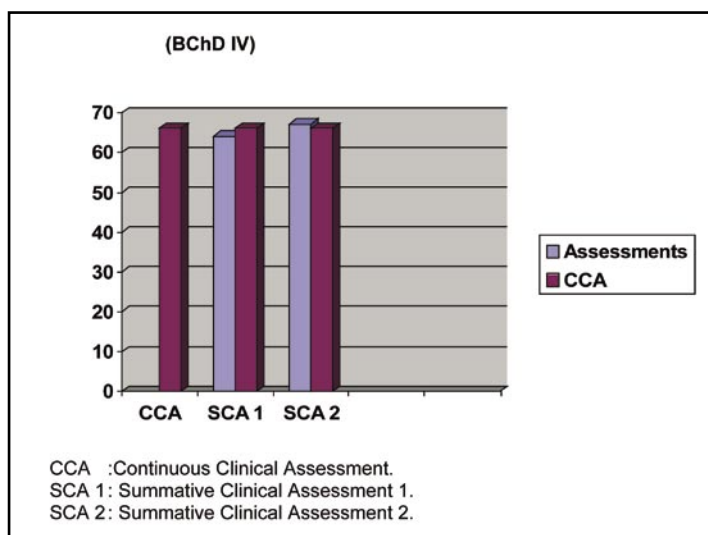
However, a summative assessment system without a formative component is still used in the Department of Restorative Dentistry at specific time points, to assess or examine an undergraduate's clinical competency in specific clinical procedures in the disciplines of Crown and Bridgework, Paedodontics, Endodontics and Basic Restorative Dentistry. These summative clinical assessments are performed under controlled conditions, but are not based on specific criteria. Each undergraduate is then assessed by multiple supervisors who are not calibrated and use traditional didactic methods of assessment that are not valid and reliable^{8,10,14,15}. These

Figure 1: Comparison of CCA vs SCA (BChD V)



CCA : Continuous Clinical Assessment.
P : Paedodontics.
C & B : Crown & Bridge.

Figure 2: Comparison of CCA vs SCA in Basic Restorative dentistry



CCA : Continuous Clinical Assessment.
SCA 1 : Summative Clinical Assessment 1.
SCA 2 : Summative Clinical Assessment 2.

summative clinical assessments are then totaled for each discipline and an average is then taken to reach a final summative clinical mark that determines whether the undergraduate is clinically competent or not. The continuous clinical assessment mark is then added to the summative clinical assessment mark and then the average of the two assessments determines the final semester mark. Summative assessment systems, used to assign a mark or grade to a student at a specific point in time, are highly subjective and variable¹⁵, and do not provide feedback useful for helping students during the learning process. Summative assessment systems are also not reliable for determining the competency of an undergraduate¹⁵. Formative assessment systems, however, have a strong positive effect upon student learning, enabling students to learn better and engage in a self-reflective process based on the feedback¹⁶. Researchers have previously attempted to determine pre-

dictors of successful performance by using results of various assessment techniques^{12, 17}. Unfortunately, measures of clinical competency do not appear to be frequently used in the competency based dental curriculum. This study compared the students' continuous clinical assessments with their summative clinical assessments for the 39 BChD V undergraduates, in the disciplines of Crown and Bridge-work, Paedodontics and Endodontics and comparisons were made for the 59 BChD IV undergraduates in the discipline of Basic Restorative Dentistry, for the 2004 academic year. The strength of the correlations resulting from this comparison will determine if CCA can be used as a successful measure of clinical competence.

MATERIALS AND METHODS

Results of the continuous clinical assessments of clinical procedures in Restorative Dentistry (BChD IV and BChD V) in the first and second semesters of the 2004 academic year were retrieved from the Microsoft Excel database. These final continuous clinical assessment marks were entered into a new Microsoft Excel® database. The summative clinical assessments, in the form of percentages, for Crown and Bridge-work, Paedodontics and Endodontics (BChD V) and Basic Restorative Dentistry (BChD IV), were entered into the same data-base (Microsoft Excel®) for further analysis. The baseline to determine clinical competence was set at 60% and any assessment achieved above this would imply clinical competence. Comparisons were made between the average continuous clinical assessments and the average summative clinical assessments in the disciplines of Crown and Bridge-work, Paedodontics, and Endodontics for the BChD V group and comparisons were made in the discipline of Basic Restorative Dentistry for the BChD IV group. Comparisons of each student's continuous clinical assessment and summative clinical assessments in the different disciplines were undertaken for the 39 BChD V undergraduates and the 59 BChD IV undergraduates to determine if there was any correlation between the continuous clinical assessment and the summative clinical assessments in the different disciplines.

Statistical Analysis

The data was analysed using a two-sample t-test to determine the significance of the comparisons between the average continuous clinical assessments and the average summative clinical assessments. A Spearman Rank Order Correlation test was used to determine if there was a correlation between the continuous clinical assessments and the summative clinical assessments of each student.

Results

The differences between the BChD V students' average continuous clinical assessments and the average summative clinical assessments for Crown and Bridgework ($p=0.00$), and Endodontics ($p=0.03$) were significant. There was no

Table 1: Assessment averages: BChD V

	CCA*	SCA** Crown & Bridge	SCA** Paedodontics	SCA** Endodontics
BChD V	62%	54%	64%	65%

* CCA: Continuous Clinical Assessment **SCA Summative Clinical Assessment

Table 2: Assessment averages for Basic Restorative Dentistry: BChD IV

	CCA*	SCA** 1 st semester	SCA** 2 nd semester
BChD V	66%	63%	67%

* CCA: Continuous Clinical Assessment **SCA Summative Clinical Assessment

Table 3: Correlation coefficients: BChD V

	SCA** Crown & Bridge	SCA** Paedodontics	SCA** Endodontics
BChD V	0.358	0.273	0.117

Table 4: Correlation coefficients: BChD V

	SCA** 1 st semester	SCA** 2 nd semester
BChD V	0.328	0.211

significant difference between the average continuous clinical assessment and the average summative clinical assessment for Paedodontics ($p=0.22$). The difference between the BChD IV students' average continuous clinical assessments and the average summative clinical assessments for Basic Restorative Dentistry ($p =0.00$) was significant. There was a weak correlation between the continuous clinical assessments and the summative clinical assessments. The results of the Spearman Rank-Order Correlation Test contrasted with the results of the two-sample t-test.

The average assessment values for BChD V group and BChD IV group are presented in Tables I and II and graphically illustrated in Fig. 1 and 2. The correlation values for BChD V group and BChD IV group are presented in Tables III and IV.

BChD V

The average assessment for the BChD V group was 62 % for continuous clinical assessment, 54 % for Crown and Bridge-work, 64 % for Paedodontics, and 65 % for Endodontics. The average assessments for Paedodontics and Endodontics for the BChD V group was above 60 % except for Crown and Bridgework, suggesting that in this study continuous clinical assessment cannot be used as a predictor of clinical competency for this discipline. The Spearman Correlation Coefficients for the BChD V students were 0.273 for Paedodontics, 0.358 for Crown and Bridge-work and 0.117 for Endodontics.

BChD IV

The average assessment for the BChD IV group in Basic

Restorative Dentistry was 66 % for continuous clinical assessment, 63 % for the first semester clinical assessment and 67 % for the second semester clinical assessment. The average assessment for Restorative Dentistry in the first and second semester for the BChD IV group was above 60 % assessment, suggesting that continuous clinical assessment can be used as a predictor of clinical competency in Basic Restorative Dentistry. The Spearman Correlation Coefficients for the BChD IV students were 0,328 for Basic Restorative Dentistry in the first semester and 0,211 for Basic Restorative Dentistry in the second semester.

DISCUSSION

Assessment influences cognitive and operant aspects of learning¹⁷. The cognitive aspects of learning are influenced by the content of the assessment suggesting that students will only learn the objectives that will be assessed. When the objectives of the educational programme do not correspond with the objectives of the assessment programme, students will use the objectives of the assessment programme to determine what will be studied¹⁷. The operant aspects of learning involve the techniques used by students to learn and how effectively they utilize these techniques. Learning outcomes in outcomes-based education necessitates cognitive and operant assessment tools¹⁸. Learning outcomes in an outcomes-based education programme focus on what the learner is accountable for¹⁸. In Restorative Dentistry the undergraduate dental students are accountable for the restorative dental procedures that they perform on patients and the competency based continuous clinical assessment system ensures that these procedures are performed competently¹⁹. The criteria-referenced self-assessment system used for the continuous clinical assessment includes formative and summative tools that have a strong positive effect on undergraduate learning and clinical skills¹⁹.

The assessment of clinical competence also requires that undergraduate dental students perform specific procedures at pre-arranged times under clinical exam conditions. The successful completion of these procedures independently is a requirement that must be satisfied in order for the students to progress to the next stage of the learning experience or to graduate as a competent clinician. The baseline mark for determining clinical competence of the undergraduates, in the Department of Restorative Dentistry at the University of Pretoria, School of Dentistry, is 60 %. The average values of the summative clinical assessments indicate that the BChD V students on average, were clinically competent in Paedodontics and Endodontics. The individual assessments, however, indicate that nine (23 %) students were not competent in the disciplines of Paedodontics and nine (23 %) students were not competent in the disciplines of Endodontics. The average value of the summative clinical assessments for Crown and Bridge-work indicate that on average, the BChD

V students were not clinically competent. By this measure, only five (13 %) students were competent in Crown and Bridge-work. The results indicate that more valid and reliable assessment methods are required to determine clinical competence in this discipline.

The average values of the summative clinical assessments in Basic Restorative Dentistry indicate that on average, all 59 BChD IV students were clinically competent in Basic Restorative Dentistry. However, the individual marks indicate that fourteen (24 %) of the BChD IV students were not clinically competent in Basic Restorative Dentistry. A greater number of students, however, performed more competently when comparing their summative clinical assessments with their continuous clinical assessments for the BChD V and BChD IV students.

The results of the Spearman Rank-Order Correlation Test contrasted with the results of the two-sample t-test, indicating that correlation tests are not appropriate when comparing clinical assessments allocated by multiple supervisors due to the lack of inter-rater reliability. The weak correlations in this study confirm this and are supported by similar findings by Pitts et al (2002) who stated that correlation coefficients are contraindicated when measuring inter-rater reliability¹³. According to Pitts et al, correlation coefficients should not be used when comparing assessments allocated by multiple supervisors because they are not good at measuring agreement because they ignore systematic differences between assessors. Correlation tests would be more appropriate if the summative clinical assessment in this study used criteria-referenced assessment for the assessment of procedures. Further studies are, however, needed to prove this hypothesis. The two-sample t-test was therefore a more accurate and reliable statistical method for analyzing the data in this study.

Very little research has been published on the predictors of successful performance and the factors influencing study success^{2, 12, 17, 19}. Many students fail an exam because they have not spent enough time preparing themselves sufficiently¹⁷. The same principle applies to dental undergraduates performing clinical procedures for clinical assessment. The results of this study have shown significant differences between the average values of continuous clinical assessments and the average values of the summative clinical assessments in Paedodontics, Endodontics and Basic Restorative Dentistry. Continuous clinical assessment can be used to overcome unpreparedness and therefore be used to accurately predict a students' clinical competence. Since continuous assessment drives the learning process^{17, 19}, students are determined to obtain the best clinical assessment. The criteria referenced self-assessment system helps to drive this learning process. Undergraduates therefore reduce their dependency on supervisors and perform more procedures independently and competently.

CONCLUSION

This study revealed the predictive potential of continuous clinical assessment. Continuous clinical assessment can be a useful tool to determine clinical competency of clinical procedures performed by undergraduates in Paedodontics, Endodontics and Basic Restorative Dentistry. The continuous clinical assessment allows undergraduates to focus on learning outcomes that will make them competent clinicians. The competency-based curriculum will ensure that the summative clinical exam becomes a relic of the past.

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