Developing an Assessment-of-Clinical-Exodontia-Skills (ACES) Rating Scale for Undergraduate Dental Students

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ABSTRACT

Objective: To develop assessment-of-clinical-exodontia-skills (ACES) rating scale for formative and summative assessment of undergraduate dental students performing exodontia.

Place and Duration of Study: Faisalabad Medical University, Faisalabad, from May 2017 to February 2018.

Methodology: A preliminary scale was developed using literature search and informal discussion with experts. In the first round of Delphi, this scale was emailed to oral surgery faculty across Pakistan. Their opinions were sought and the form was modified accordingly. In the second round, the modified form was emailed again to the respondents of first round and thus the form was finalized by obtaining their comments on the modified form.

Results: A preliminary 27-point round-1 questionnaire was sent to 42 experts. Out of these, 30 responded (overall response rate 71.4%) and the form was modified according to their response. Frequency, percentage, and mean of Likert-based responses was calculated along with thematic analysis of individual responses. In round 2, the modified form was sent to the 30 respondents of round 1. Out of these, 21 replied (response rate 70%) and form was further modified accordingly. In round 2, primary focus was on marking/scoring strategy.

Conclusion: ACES form was developed, which can be important tool in assessing exodontia skills of undergraduate dental students. This needs practical application and testing for validity.

Key Words: *Tooth extraction, Dental students, Educational measurement.*

INTRODUCTION

Acquisition of procedural skills and display of working knowledge is a mandatory requirement for a dental student.[1] Exodontia or removal of tooth is a core competency that a dental student must be adept in, *i.e.* he/she must possess sufficient knowledge, skill, and attitude for the procedure.[2] According to Miller, exodontia is placed at the level of "Does" for the undergraduate students as they have to perform a tooth extraction in their final professional examination.[3] In order to reach that level, they are rotated in the oral surgery department during their third and final years where they learn to perform various steps associated with the procedure of tooth extraction.

Every institution has its own way of assessing students performing exodontia.[4] Most of the dental schools in United Kingdom use OSCE or a checklist-based formative assessment tool such as structured clinical operative test (SCOT) or a checklist assessment of

operative skills (CAOS).[5] In most of the dental colleges in Pakistan, the students are observed by the faculty and are required to maintain a log book of nature of procedure performed, which is signed by a faculty member later on. No such formal checklist-based assessment system is in place. The log book fails to represent the actual competency a student has achieved, and there is a deficiency of formal feedback towards the student's performance.[6] This lack of feedback and inadequate workplace-based assessment result in unsatisfactory performance in the final examinations.

The objective of this study was to develop a rating scale by consensus of faculty of oral surgery (Delphi technique), which can assess students on a universally accepted scale and apprise them of their true competence. Once developed, the scale will be available to the faculty members/institutes for assessing the competence of their students in exodontia, both formatively as well as summatively.

METHODOLOGY

A 2-round Delphi technique was employed with a concurrent mixed method study design. In order to develop an exodontia rating form, literature search and an informal discussion with a panel of three experts was done to formulate a preliminary rating scale. All the faculty members of oral surgery (Assistant Professors and above) working in institutes across Pakistan were included in the study. Oral surgeons, not appointed as faculty in teaching institutes, were excluded from the study. In the first round, preliminary rating scale along

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with a brief background/introduction of the study was shared with the oral surgery faculty through emails in the form of a questionnaire to get their input regarding face and construct validity of the instrument. The questionnaire comprised of 27 Likert-based responses and columns for individual responses by the experts. Follow-up through reminder emails, calls and messages for return of Delphi round 1 survey forms was done. The data collected in Delphi round 1 was analysed and preliminary scale was modified by incorporating valid suggestions received from experts. In the round 2, the modified form was shared through email with the respondents of round 1 to get a consensus on the final form.

The data thus gathered were analysed using SPSS version 20. Frequency was calculated for number of responders. Since it was a mixed type questionnaire, the Likert-based responses were analysed; and we calculated mean and standard deviation of the individual responses. For the qualitative component of the form, thematic analysis was done. Finally, a statistical average of the final opinion of experts was calculated.

RESULTS

In Delphi round 1, a 27-point questionnaire was sent to a total of 42 subject experts all over the country. Out of these 42, 30 experts replied to the questionnaire with an overall response rate of 71.4%. Teaching experience of the experts ranged from 6 months to 25 years with a mean of 7.758 ±6.94 years. Experts who responded included 8 professors (26.7%), 4 associate professors, (13.3%) and 18 assistant professors (60%).

The preliminary questionnaire that was shared in round 1 was a mixed type questionnaire consisting of individual 27 Likert scale-based rating questions (quantitative component) and columns for individual qualitative responses from the expert. The questions were based on sub-competencies that the authors considered vital for a student performing exodontia. The experts were asked to highlight whether in their opinion those sub-competencies were highly important, important, unimportant, not required at all or if they were undecided about them. They were also requested to add any competency which according to them would be vital for the assessment of final year student performing tooth extraction. Thematic analysis of individual responses was done and the results are shown in Table I. Five themes emerged as following universal precautions, rate of position of local anesthesia, using aspirating syringe for local anesthesia, knowledge about procedural complications and tooth luxation and delivery.

The questionnaire of round 1 was modified according to the comments of the experts and the modified question-naire was sent to the 30 respondents of round 1. Out of these 30, 21 experts responded to round 2 questionnaire (overall response rate for round 2 was 70%).

Table I: Showing overall results of Delphi round 1.

Question	Highly important	Important	Undecided	Un-important	Not required at all	Mean score
Greets and Introduces oneself	19 (63.3%)	11 (36.7%)	-	-	-	4.93
Acquires informed consent	28 (93.3%)	2 (6.7%)	-	-	-	4.63
Acquisition of proper history	25 (83.3%)	5 (16.7%)	-	-	-	4.83
Performs pertinent clinical examination	24 (80%)	6 (20%)	-	-	-	4.80
Dons personal protective equipment	22 (73.3%)	7 (23.3%)	1 (3.3%)	-	-	4.70
Employs aseptic technique	23 (76.7%)	6 (20%)	1 (3.3%)	-	-	4.73
Positions patient properly	18 (60%)	12 (40%)	-	-	-	4.60
Positions oneself properly according to the tooth	17 (56.7%)	9 (30%)	3 (10%)	1 (3.3%)	-	4.40
Selects correct instruments	24 (80%)	6 (20%)	-	-	-	4.80
Places instruments correctly	7 (23.3%)	22 (73.3%)	1 (3.3%)	-	-	4.20
Chooses type of local anesthesia correctly	21 (70%)	9 (30%)	-	-	-	4.70
Checks expiry date of the cartridge	21 (70%)	7 (23.3%)	1 (3.3%)	1 (3.3%)	-	4.60
Loads syringe properly	10 (33.3%)	14 (46.7%)	5 (16.7%)	1 (3.3%)	-	4.10
Knowledgeable of relevant anatomy	27 (90%)	3 (10%)	-	-	-	4.90
Deposits anesthetic solution and needle withdrawal	19 (63.3)	9 (30%)	2 (6.7%)	-	-	4.57
Asks about change in sensation	9 (30%)	21 (70%)	-	-	-	4.30
Performs gingival probing to assess local anesthesia	19 (63.3%)	11 (36.7%)	-	-	-	4.63
Reassures patient about pain/pressure	16 (53.3%)	14 (46.7%)	-	-	-	4.53
Knows adjunctive measures in case of failure of anesthesia	15 (50%	15 (50%)	-	-	-	4.50
Ensures correct tooth	28 (93.3%)	2 (6.7%)	-	-	-	4.93
Uses periosteal elevator properly	14 (46.7%)	15 (50%)	1 (3.3%)	-	-	4.40
Properly uses Coupland's elevator where needed	17 (56.7%)	10 (33.3%)	3 (10%)	-	-	4.47
Applies forceps properly	22 (73.3%)	8 (26.7%)	-	-	-	4.73
Retracts and supports jaw correctly	20 (66.7%)	10 (33.3%)	-	-	-	4.67
Performs adequate care of the socket	23 (76.7%)	7 (23.3%)	-	-	-	4.77
Gives postoperative instructions	25 (83.3%)	5 (16.7%)	-	-	-	4.83
Prescribes medicines appropriately	15 (50%)	13 (43.3%)	2 (6.7%)	-	-	4.43

Table II: Showing results of Delphi round 2.

Sub-competency	Mandatory	No.	Percentage
Greets and introduces oneself	16	05	76.2%
Takes pertinent history	20	01	95.2%
Performs clinical examination	17	04	81%
Advises and interprets radiographs	05	16	23.8%
Develops diagnosis	11	10	52.4%
Takes informed consent	14	07	66.7%
Wears PPE	13	08	61.9%
Maintains asepsis and follows universal precautions throughout the procedure	17	04	81%
Knows the anatomical landmarks for anesthesia administration	17	04	81%
Correct choice and dosage of LA	13	08	61.9%
Checks expiry of cartridge	05	16	23.8%
Positions oneself properly for LA administration	19	02	90.5%
Employs proper technique for LA	21	-	100%
Re-sheathing and securing of needle	04	17	19%
Confirms successful LA by gingival probing	15	06	71.4%
Reassures patient regarding pain and pressure	07	14	33.3%
Knows adjunctive measures in case of failure of LA	18	03	85.7%
Ensures correct tooth	17	04	81%
Positions oneself properly for extraction	08	13	38.1%
Arranges armamentarium properly	04	17	19%
Properly applies periosteal elevator	20	01	95.2%
Properly applies Coupland's elevator (where needed)	20	01	95.2%
Properly applies forceps	20	01	95.2%
Properly retracts and supports jaw	21	-	100%
Luxates and delivers tooth	21	-	100%
Knowledgeable about complications of exodontia	10	11	47.6%
Gives proper postop instructions	20	01	95.2%
Takes care of the extraction socket	15	06	71.4%
Prescribes adequate postop medication	12	09	57.1%

Table III: Showing components and marks distribution as advised by the experts.

Component	Percentage Marks (Minimum)	Percentage Marks (Maximum)	Mean	Standard Deviation	Standard Error
Preoperative assessment	10	20	14.29	3.96	0.86
Cross-infection control	0	15	10.95	3.74	0.81
Local anesthesia	25	35	29.29	3.27	0.71
Extraction	30	45	35.95	4.90	1.07
Postoperative instructions and medication	5	20	9.76	4.02	0.87

Two rating scales for assessment were considered and the experts were asked to decide which scale was better in their opinion for assessment of students. First scale comprised of 4 categories: G=good, S=satisfactory, U=unsatisfactory, and N/O=not observed. The second scale comprised of 5 points: 5=excellent, 4=good, 3=satisfactory, 2=unsatisfactory, 1=poor, N/O=not observed. Out of 21, 5 experts (23.8%) favoured GSU scale while the rest 16 experts (76.2%) suggested the 5-Point Likert-scale.

In the questionnaire of round 2, the experts were asked to determine sub-competencies which in their opinion were absolutely necessary in order to declare a candidate successful in their assessment. The results of these responses are shown in Table II.

The questionnaire was divided into five segments namely; preoperative assessment, cross-infection control, local anesthesia, extraction, and postoperative instruction. The experts were also asked to assign weightage to each component so that marking scheme could be finalised. The results are shown in Table III.

DISCUSSION

Assessment of exodontia is a vital part of the dental undergraduate curriculum.[7,8] There is a paradigm shift in modern day education from knowledge to competency. Hence, the objective of this study was to develop a rating scale which can be used to assess the clinical competence of dental students performing tooth extractions.[9]

Delphi technique is an iterative process of gathering information and judgements through series of rounds/ questionnaires distributed among experts till a consensus is reached.[10,11] In this study, a preliminary form was circulated among the subject experts and their opinions were sought; and the form was modified and re-circulated so that it could be finalised. The participation of the experts was voluntary and complete confidentiality and anonymity was maintained.

A systematic process of questionnaire development was followed as mentioned in the AMEE guidelines.[12,13] A literature review followed by an informal discussion among the two experts and the principal investigator was conducted to develop the preliminary questionnaire,

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Competency	Sub-competency	5	4	3	2	1	N/O
Pre-op patient assessment	Greets and Introduces oneself						
	*Acquires pertinent history and identifies comorbid conditions						
	*Performs pertinent clinical examination						
	Advises and interprets radiographs (when needed)						
	Develops diagnosis and justifies extraction						
	*Takes informed consent						
	Marks: /30x15=						
Local anesthesia	*Knows anatomical landmarks						
	Ensures correct choice & dosage of LA						
	Checks expiry date of the cartridge						
	*Positions oneself properly according to anesthesia administration						
	*Appropriate loading of syringe, proper selection and entry of needle, confirms negative aspiration and deposits adequate amount of solution						
	Re-sheathing and securing of needle after injection						
	Confirms success of anesthesia by asking the patient about change in sensation and gingival probing						
	Reassures patient about pain and pressure sensations						
	Knows adjunctive measures in case of failure of anesthesia						
	Marks: /45x30=						
Extraction technique	*Ensures correct tooth						
	Positions patient and oneself properly according to the tooth to be extracted						
	Identifies and arranges the required armamentarium correctly						
	*Applies periosteal elevator properly						
	*Judiciously uses elevators (if needed)						
	*Grips forceps and applies force properly						
	*Ensures proper retraction and jaw support						
	*Luxates and delivers tooth properly						
	Knowledgeable about management of common complications of exodontia						
	Marks: /45x35=						
Cross-infection control	*Maintained cross infection control and followed universal precautions throughout the procedure						
	Marks: /5x10=						
Post-op management and care	Socket care and hemostasis						
	*Provides proper postoperative instructions						
	Prescription writing						
	Marks: /15x10=						

Overall Marks: /100

Decision of the examiner: Pass/Fail/Borderline

Feedback Comments: _____

Date: _____   Signature: _____

Key: 5=Excellent, 4=Good, 3=Satisfactory, 2=Unsatisfactory, 1=Poor, N/O=Not Observed.
*Marks the sub-competency considered mandatory for the candidate to pass.

Figure 1: ACES form.

which was sent to subject experts for validation. One of the most vital elements in Delphi study is identifying 'experts' who should be the specialist of the field.[14] In this study, the experts were identified as those faculty members who were directly involved in the under-graduate teaching and training and were working as Professors, Associate Professors or Assistant Professors of oral surgery across dental institutes of Pakistan. An overall response rate of 71.4% was received in round 1 and 70% in round 2. An almost similar response rate has been reported by Elwyn *et al*. in their Delphi study.[15]

Opinion-based Likert scales are commonly employed in healthcare as well as educational research. Data is gathered on these questionnaire followed by content analysis.[16] In this study, both quantitative and qualitative data were generated. Quantitative content analysis was done and individual frequency and mean score was calculated for each response. Following the concept of statistical average in Delphi studies,[17] all those sub-competencies were retained in the form whose mean score was above 4 because it meant that they were considered important or highly important by the experts.

Qualitative content analysis is a systematic process for identifying themes and phenomenon in research.[18] Three approaches for thematic analysis have been described in literature by Hsieh *et al.,* namely conventional, directed and summative.[19] The authors employed conventional approach and deducted themes/codes directly from text data, and which were later incorporated in the round 2 form.

In round 2, the major focus was on marking scheme and overall marks distribution. Two scoring scales were suggested: GSU (good, satisfactory and unsatisfactory), and a five-point Likert scale (5=excellent, 4=good, 3=satisfactory, 2=unsatisfactory, 1=poor). Majority of the experts (76.2%) were in favour of the 5-Point Likert. Hence, it was selected as final scoring scale in the proforma.

The experts were asked to highlight sub-competencies in the form which they considered absolutely necessary for a candidate to perform satisfactorily in order to be declared successful. The sub-competencies, about which more than 80% of the experts suggested as mandatory, were marked with an (*) in the final form. It was decided that any student performing unsatisfactorily or poorly in these mandatory competencies will be considered fail despite his/her overall score.

The final question that was asked from the experts was marks distribution. The form was divided into five components for this purpose: preoperative assessment, cross infection control, local anaesthesia, extraction and post-op instructions, and medications. These sub-components have also been pointed out by MacLuskey *et al*.[5] According to the weightage of each component in exodontia, the experts were asked to assign marks

weightage to each component. Final mean score was rounded off to the nearest whole number. As a result, 15% marks were assigned to preoperative assessment, 10% were assigned to cross-infection control, 30% to local anaesthesia administration, 35% to extraction and 10% to postoperative instructions and medication. Final score will be a sum total of all the scores acquired in each component. A candidate attaining 50 or 60% (depending upon the passing criteria of individual institute) of the total score will be declared pass provided he/she is awarded at least satisfactory score in the mandatory competencies.

The final scale that emerged as a result of this study was named as ACES form (Figure 1), and it is attached as appendix for future use and validation purposes. Since it was a Delphi technique-based study, hence all the limitations of a Delphi approach mentioned in literature applies to this research as well.[14,17,20] Some of these include forced or intuitive judgement from the experts, relatively low reliability, inability to reach a true consensus and biased results subject to ambiguity in questionnaire. The authors tried their best to minimise these limitations as humanly possible.

One limitation, particular to the study, was that the authors were able to achieve face and content validity of this tool; but the criterion and construct validity along with inter-rater reliability still needs to be carried out.[21] So, future research is still needed in order to get the form tried and tested before it can become a part of the assessment process throughout the country.

CONCLUSION

Assessment of clinical skills is a vital requirement for students. The ACES scale, developed as a result of this study, can be a useful tool for formative as well as summative assessment of undergraduate dental students. However, it has to be validated before it can be put into use.

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