

ORIGINAL ARTICLE

Developing Faculty Consensus for Undergraduate Orthodontic Curriculum

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ABSTRACT

Objective: To develop faculty consensus of orthodontic learning outcomes associated with knowledge and skills of “Treatment” required for undergraduate students.

Study Design: Qualitative study

Place and Duration of Study: Islamic International Dental College, Islamabad, 15th January, 2016 to 15th March, 2016.

Materials and Methods: A Delphi method was used in two rounds to develop consensus by orthodontic faculty from various dental colleges of Pakistan. Learning outcomes related to skills were formulated in the form of a questionnaire and sent to study participants. A five point likert scale was used to obtain perception of dental faculty. Later, a qualitative approach was adopted by giving open ended questions associated with skills required in “Treatment” part of undergraduate orthodontic course. The quantitative data was analyzed by using SPSS version 20. The qualitative data was obtained and analyzed using NVivo version 11.

Results: Twenty participants (N= 20) responded with their feedback to closed-ended first questionnaire and sixteen participants responded to the second open-ended questionnaire. Out of the 28 learning objectives, participants achieved consensus on 21 items particularly on knowledge and skills related to treatment planning for mixed dentition in first round. Whereas in second round, out of seven non consensus items, two learning objectives, three dimensional location of maxillary canine and skill in fabrication of functional appliances could not achieve consensus.

Conclusion: The orthodontic faculty agreed that undergraduate students must have skills of history taking, oral examination, x-ray, and removable appliances for orthodontic discipline.

Key Words: *Dental Student, Learning Outcome, Malocclusion, Orthodontics, Teaching Methods.*

Introduction

Undergraduate course of orthodontics is a considerable part of the overall dental programme. The undergraduate students get an opportunity to deal with dental patients to have knowledge and skills on almost all aspects of orthodontic treatment. They treat orthodontic patients by themselves using their knowledge and skills acquired during their posting in orthodontic department. The study of orthodontics enables them to examine orthodontic

patients but they cannot make proper treatment plan especially in complex cases.¹

The early diagnosis and referral of orthodontic cases have been suggested for providing the best care to patients. Referrals are made usually by general dental practitioners (GDP) and pediatric professionals. It is required that they are well informed about the correct diagnosis of early malocclusion problems. The referral practitioners especially GDP decide when and where to send or refer an orthodontic patient.^{2,3}

A previous study has found that dental students lack skills to recognize malocclusion and use dental instruments to diagnose orthodontic cases. Some curricula emphasize more on diagnosis of a malocclusion. Studies have shown that general dentists provide many comprehensive orthodontic treatment procedures even they are not specialized to precede such cases.^{6,7} such as malocclusions like cross bite, open bites and deep bites.^{8,9}

There is a list of contents in the national curriculum of BDS, without any distinction of knowledge and skills required at undergraduate level.¹⁰ Faculty

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Funding Source: NIL; Conflict of Interest: NIL

Received: Oct 14, 2016; Revised: Mar 03, 2017

Accepted: Mar 06, 2017

members find difficulty when visit to other dental colleges as external examiner in the non structured examinations. They come across that there were not proper guideline to learning outcomes of orthodontic course at various colleges.¹¹ They suggested performing careful planning in order to promote the study skills in undergraduate students. This study aimed to develop consensus on the optimal orthodontic course learning outcomes associated with skills to treat mixed dentition cases of orthodontics carried out in undergraduate bachelor of dental surgery programme.

Materials and Methods

The study was approved by the institutional ethical review committee. A Delphi technique was used with two rounds, in first round a quantitative questionnaire and in second round a qualitative questionnaire was circulated to the participants. A self-administered questionnaire was developed with item responses based on 5-point Likert scale. The validity and reliability of the questionnaire were done by involving subject experts of two institutions. The questionnaire was based on the principles given in AMME Guide 87 by Artino et al.¹²

Inclusion criteria of study participants were professional education and experience. Thus orthodontic faculty members with minimum three years teaching experience and holding either fellowship from the College of Physician and Surgeons Pakistan (CPSP), Royal College of Surgeons England (RCSE), Royal College of Physician and Surgeon (RCPS) Edinburgh, Royal College of Surgeon, Glasgow and Royal College of Surgeon Ireland were included as study participants. Other than fellowship, faculty members holding Master in Dental Surgery (Orthodontics) and Master of Science (MS) were also included.

Twenty-eight Learning outcomes (LOs) associated with skills required in "Treatment" part of orthodontics in undergraduate course were circulated through emails to selected orthodontic participants (N=42). Learning outcomes were in the form of questionnaire with five point likert scale where 'Strongly disagree (SDA), Disagree (DA), Neutral (N), Agree (A) and Strongly Agree (SA) were parameters. Later 'SDA, DA, N' were combined as one set and labeled as No consensus and 'A, SA' were put together as 'Consensus'. In this way, consensus

were obtained. Learning outcomes are shown in table I.

Table I: Learning outcomes associated with skills required during orthodontic course

No	Statement (Learning Outcomes)
1	Develop a problem list and preliminary treatment plan by using history and clinical examination
2	Examine extra & intra oral features of deep bite
3	Examine extra & intra oral features of open bite
4	Describe different methods of treating posterior cross bite
5	Formulate various treatment protocols of crowding
6	Demonstrate the spacing problems in various dentitions time
7	Compare various types of cross bites (Skeletal/ Dental / Ant./ Post.)
8	Explain the dental and skeletal cross bites in transverse and horizontal plane
9	Develop a preliminary treatment plan (by using basic diagnostic aids (Cephalographs, OPG , Study casts etc)
10	Develop a definitive treatment plan (by using basic diagnostic aids (Cephalographs, OPG , study casts etc)
11	Differentiate between dental and skeletal class II problems
12	Propose various methods of treating the skeletal class II problems
13	Arrange intra and extra oral features of class II non skeletal and skeletal problems
14	Demonstrate abnormal shapes of teeth on radiographs and clinically (e.g; peg laterals
15	Determine the dental age on Orthopentograph (OPG)
16	Differentiate between normal palatal bone and a cleft bone on x ray views (peri-apical / occlusal)
17	Describe general principles of treatment of Class II division 1 dental problems)
18	Assemble intra and extra oral features of class II Div 2 non skeletal problems
19	Locate the position of impacted teeth in 3 planes of space by Parallax technique (specially maxillary canines), by using lateral ceph and OPG
20	Formulate the rationale of treatment of skeletal class II in various age groups
21	Take the detailed orthodon tic history in a systematic way
22	Measure the cross bite and expansion required on study casts
23	Apply the elastomeric separators on mixed dentition patient
24	Select and cement the bands for molar teeth on mixed dentition patient
25	Insertion and activation of simple removable appliances
26	Insertion and adjustment of Hawley's retainers
27	Fabricate and adjustment of the simple removable appliance with various designs
28	Registration of bite, fabrication, insertion and follow up of functional appliances in Class II & III patients

The questionnaire two in the second round was an open-ended questionnaire with six questions to know the depth of the non-consensus items from previous round. Interview were in between the period, feedback of faculty on telephone and two audio recorded meetings were arranged at regional centre, College of Physicians and Surgeons Pakistan (CPSP), Islamabad, with 16 faculty members. The audio recording was later transcribed to word file and the comments were added in the responses of the respective faculty members.

Statistical Package for Social Sciences (SPSS version 20.0) was used for descriptive analysis of quantitative data whereas qualitative data was analyzed using NVivo version 11.

Results

The response rate in the first round was 48 % whereas in the second round (qualitative) it was 80 %. There were 3 professors, 8 associate professors and 9 assistant professors who participated in the first round. Sixteen faculty members participated in the second round.

The analysis of first round showed consensus in items particularly on knowledge and skills related to treatment planning, class II, class III, and space problems in mixed and permanent dentition. Twelve items related to fixed appliances, functional appliances, maxillary canine diagnosis and skills in mixed dentition period could not receive consensus. One of the respondents enquired about the operational definition of the terms used in defining the learning objectives, so that all faculty members would be on same page.

Over 80% participants in round one agreed to include history taking and clinical examination in undergraduate dental programme as learning outcome. Similarly cephalographs, orthopontogram (OPG), study casts and photographs were also given ‘agreed’ to be included by the participants (Table II). Less than fifty percent agreed on definite treatment plan by undergraduate dental students. Out of 10 learning outcomes (LOs) about ‘Malocclusion of Permanent Dentition’ all did not agree on two LOs which were ‘Formulate various treatment protocols of crowding’ and ‘develop a definite treatment plan’ while remaining 8 had obtained 90 % consensus (Table II).

Regarding LOs of skeletal and dental class II, most of

the LOs were given consensus more than 90% (as agreed). Three out of eight learning outcomes were agreed 100% by all participants. In contrast, the LOs of “differentiation between palatal bone and cleft bone” and “location of impacted canine” did not receive consensus (Table III).

Los about skills performed by undergraduate students. In this category learning outcome ‘Measure the cross bite and expansion required on study casts, select and cement the bands for molar teeth on mixed dentition patient and registration of bite, fabrication, insertion and follow up of functional appliances in Class II & III patients’ were rejected by participants (Table IV).

Qualitative Aspect

In second round, seven non-consensus learning outcomes were further explored qualitatively through open-ended questions. The qualitative results are summarized (Table V).

Discussion

The number of practical exercises varies among dental institutes resulting into a variety of graduates with variable competencies to handle patients of orthodontic problems. These graduates when enter into clinical practice depict variety of skills in orthodontic technique and in treatment planning for the common orthodontic malocclusions. This results into low quality of orthodontic services and poor referral by the general dental practitioners. Thus the community dental health is directly related to the quality of its dental graduates, this study focused on realistic objectives or outcomes to be decided for graduates with good basic skills of

Table II: Consensus on learning outcomes associated with malocclusion of permanent dentition

NO	Statement	SDA*	DA*	N*	A*	SA*	Consensus	
		n (%)	n (%)	n (%)	n (%)	n (%)	Yes	NO
1	Develop a problem list and preliminary treatment plan by using history and clinical examination	0 (0%)	0 (0%)	0 (0%)	11 (55%)	9 (45%)		
2	Examine extra & intra oral features of deep bite	0 (0%)	2 (10%)	0 (0%)	14 (70%)	6 (30%)	v	
3	Examine extra & intra oral features of open bite	0 (0%)	0 (0%)	1 (5%)	8 (40%)	11 (55%)	v	

4	Describe different methods of treating posterior cross bite	0 (0%)	0 (0%)	2 (20%)	8 (40%)	10 (50%)	v	
5	Formulate various treatment protocols of crowding	0 (0%)	4 (20%)	7 (35%)	5 (25%)	4 (20%)		v
6	Demonstrate the spacing problems in various dentitions time	0 (0%)	0 (0%)	7 (35%)	9 (45%)	4 (20%)	v	
7	Compare various types of cross bites (Skeletal/ Dental / Ant./ Post.)	0 (0%)	2 (10%)	3 (15%)	3 (15%)	12 (60%)	v	
8	Explain the dental and skeletal cross bites in transverse and horizontal plane	0 (0%)	0 (0%)	1 (5%)	6 (30%)	13 (65%)	v	
9	Develop a preliminary treatment plan (by using basic diagnostic aids (Cephalographs, OPG , Study casts etc)	0 (0%)	0 (0%)	0 (0%)	11 (55%)	9 (45%)	v	
10	Develop a definitive treatment plan (by using basic diagnostic aids (Cephalographs, OPG , study casts etc)	0 (0%)	11 (55%)	5 (25%)	2 (10%)	2 (10%)		v

*SDA=Strongly disagree, DA=Disagree, N=Neutral, A=Agree, SA=Strongly Agree

orthodontics. However, there was a lack of assessment of students on the selected or consensuses learning outcomes which was a limitation of this study.

The faculty members had consensus related to skill of removable appliances for undergraduates. All faculty members were of the opinion to have basic knowledge and skill in basic removable appliance design, appliance fabrication, its activation and instructions of use. Faculty members generally had an opinion on functional appliances learning objectives. These results are comparable with the competencies defined by General Dental Council, UK, and as per the study conducted in the Newcastle University, UK, where they have defined that their students develop a basic skill in appliance design, fit, and monitor in correcting posterior cross bites and single tooth anterior cross bites.¹³ In some parts of the world, general dental

Table III: Consensus on Skeletal & Dental Class II related learning outcomes

NO	Statement	SDA* n (%)	DA* n (%)	N* n (%)	A* n (%)	SA* n (%)	Consensus Yes NO	
11	Differentiate between dental and skeletal class II problems	0 (0%)	0 (0%)	1 (5%)	8 (40%)	11 (55%)	v	
12	Propose various methods of treating the skeletal class II problems	0 (0%)	3 (15%)	2 (10%)	11 (55%)	4 (20%)	v	
13	Arrange intra and extra oral features of class II non skeletal and skeletal problems	0 (0%)	0 (0%)	0 (0%)	7 (35%)	13 (65%)	v	
14	Demonstrate abnormal shapes of teeth on radiographs and clinically (e.g; peg laterals	0 (0%)	0 (0%)	2 (10%)	9 (45%)	11 (55%)	v	
15	Determine the dental age on Orthopentograph (OPG)	0 (0%)	0 (0%)	0 (0%)	5 (25%)	15 (75%)	v	
16	Differentiate between normal palatal bone and a cleft bone on x ray views (peri - apical / occlusal)	0 (0%)	2 (10%)	7 (35%)	7 (35%)	4 (20%)		v
17	Describe general principles of treatment of Class II division 1 dental problems)	0 (0%)	0 (0%)	2 (10%)	7 (35%)	11 (55%)	v	
18	Assemble intra and extra oral features of class II Div 2 non skeletal problems	0 (0%)	0 (0%)	1 (5%)	6 (30%)	13 (65%)	v	
19	Locate the position of impacted teeth in 3 planes of space by Parallax technique (specially maxillary canines), by using lateral ceph and OPG	0 (0%)	4 (20%)	5 (25%)	5 (25%)	6 (30%)		v
20	Formulate the rationale of treatment of skeletal class II in various age groups	0 (0%)	0 (0%)	3 (15%)	8 (40%)	9 (45%)	v	

*SDA=Strongly disagree, DA=Disagree, N=Neutral, A=Agree, SA=Strongly Agree

practitioners provide orthodontic treatment by removable appliances. In fact, the efficacy of removable appliances is not as good as fixed appliances.¹⁴

Mixed dentition space management protocol is learnt at various levels. The majority of the respondents were in the favour of that the theory of these skills would be taught at undergraduate level, but practice should be executed later during house

job or orthodontic residency. Space analysis in mixed dentition is broadly categorized such as 'Use regression equations, radiographs or a combination of both methods.¹⁵⁻¹⁸ Usually, the regression equations based on already erupted permanent teeth are used widely. In this manner, the Moyers probability charts and Tanaka Johnston equations are taken as standard.¹⁹ This is a complex technique and usually considered for postgraduate students.

Table IV: Consensus on learning outcomes associated with 'skills of orthodontic treatment

NO	Statement	SDA* n (%)	DA* n (%)	N* n (%)	A* n (%)	SA* n (%)	Consensus	
							Yes	NO
21	Take the detailed orthodontic history in a systematic way	0 (0%)	0 (0%)	0 (0%)	4 (20%)	16 (80%)	v	
22	Measure the cross bite and expansion required on study casts	0 (0%)	4 (20%)	5 (25%)	8 (40%)	3 (15%)		v
23	Apply the elastomeric separators on mixed dentition patient	0 (0%)	2 (10%)	6 (30%)	6 (30%)	6 (30%)	v	
24	Select and cement the bands for molar teeth on mixed dentition patient	0 (0%)	4 (20%)	6 (30%)	9 (45%)	1 (5%)		v
25	Insertion and activation of simple removable appliances	0 (0%)	0 (0%)	2 (10%)	5 (25%)	13 (65%)	v	
26	Insertion and adjustment of Hawley's retainers	0 (0%)	0 (0%)	2 (10%)	5 (25%)	13 (65%)	v	
27	Fabricate and adjustment of the simple removable appliance with various designs	0 (0%)	0 (0%)	2 (10%)	3 (15%)	15 (75%)	v	
28	Registration of bite, fabrication, insertion and follow up of functional appliances in Class II & III patients	2 (10%)	4 (20%)	6 (30%)	6 (30%)	2 (10%)		v

*SDA=Strongly disagree, DA=Disagree, N=Neutral, A=Agree, SA=Strongly Agree

General dental practitioners (GDPs) play a key role in making referral of orthodontic patients. But mostly they compete with orthodontists in providing the treatment especially simple cross bite cases.²⁰ The quality of orthodontic treatment is a public health issue because inappropriate treatment of a malocclusion can lead to irreparable damage.²¹ General dentists tend to treat orthodontic cases and ultimately finish these cases worse than the average professional holding a postgraduate degree in orthodontics,²² The victims of orthodontic treatment dealt by GDPs are growing because those professional lacks the necessary expertise.²³ This study may benefit to curriculum managers to develop or revise the current version of curriculum. The undergraduate orthodontic courses at Toronto and Liverpool dental schools have 250 hours of teaching and within that, more than 100 hours are allocated for clinical rotation. Both programmes contain laboratory teaching of removable and fixed appliance technique. Undergraduate students treat their own patients with both simple and complex appliances, within their clinical training period which extends over at least 2 years.^{24,25} In our study removable appliances were suggested to be included at undergraduate programme.

Table V: Open ended comments on learning outcomes associated with skills of orthodontics

<p>Theme: Fixed appliances</p> <ul style="list-style-type: none"> • Yes they should have a skill of how to place separator, cement a band and place a bracket • I think at final year level they should observe all basic fixed appliance procedures and may be can do on phantom head and later in house job can do on patients
<p>Theme: Mixed dentition space problems</p> <ul style="list-style-type: none"> • Undergraduates should be able to complete all the basic diagnostic part (e.g mixed dentition analysis). They should be able to have competence of space management, at least the space maintenance and regaining part. Space maintenance should be handled as a theme and taught in tandem with Pedodontics in operative dentistry • A final year student must know the methods used for the mixed dentition space management protocol and they must be involved in diagnosing the mixed dentition cases in clinical rotation either by attaching their assignments with the

<p>postgraduate dental students if available or by assigning preselected mixed dentition malocclusion models for the diagnose and treatment planning as quota requirement</p>
<p>Theme: Impacted canine</p> <ul style="list-style-type: none"> • Yes, to the extent that it's impacted and not visible clinically. However, interpreting vertical/horizontal parallax and advanced investigations like CBCT do not fall in the realm of undergraduate competencies • No....too much information overload
<p>Theme: Functional appliances</p> <ul style="list-style-type: none"> • Yes, because removable appliances are the scope of dental graduates all over the world, but, functional appliance fabrication is questionable • No, it's more of post graduate trainee job in conjunction with lab technician
<p>Theme: Skills at undergraduate level</p> <ul style="list-style-type: none"> • Banding bonding, know and manage orthodontic emergencies, must be able to identify space problems, must be able to identify patients which must be referred to orthodontist • Changing of wires, cutting of wires, any procedures that a general dentist faces to handle an orthodontic emergency
<p>Theme: Timing of fixed appliances skills</p> <ul style="list-style-type: none"> • A dental student must have some know how for the fixed appliance therapy gadgets, and their placement methods. The students must be involved clinically for minor procedures as mentioned in fixed appliance therapy during clinical rotations. • Since BDS is awarded before house job, this skill should be evaluated at final year level. If license exam is separate, then it can be assessed later

Though our dental schools follow national curriculum, but there is diversity in course content and the time to deliver the content also varies from institute to institute. There was also a wide variation in the orthodontic course form and content in the 12 UK dental schools. The greatest variation occurred in the clinical teaching hours (50 to 126), followed by the types of patient treatment undertaken (removable only to full fixed), the laboratory teaching hours (0 to 60), the content of the laboratory course (removable appliances to fixed appliance typodonts). But how many hours should be taught or practiced by students was a limitation. Treatment planning after the patient examination is most important part of orthodontic management. Mostly it is divided into two parts (a) treatment aims and (b) treatment plan. It is quite possible

orthodontic treatment could affect the skeletal form when functional appliances are used but it has little effect on soft tissue and arch length. Improved dental health, relief crowding, correction of buccal occlusion, reduced over bite, reduced overjet, and alignment of teeth are some basic problems that are addressed in the treatment of orthodontics. All learning outcomes related to basic skills would benefit to students.

Limitations of the Study

Further rounds of Delphi could not be done due to limited time of the study.

Conclusion

Consensus on the learning outcomes associated with knowledge and skills of orthodontic treatment were achieved. They included history taking, radiographic interpretation and removable appliances.

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