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How Well Prepared Are Dental Students and New Graduates in Pakistan-A Cross-Sectional National Study

Muhammad Qasim Javed [1,*]**, Shazia Nawabi** [2]**, Usman Anwer Bhatti** [3] **, Sundus Atique** [4]**, Mustafa Hussein AlAttas** [1]**, Ayman M Abulhamael** [5]**, Daniel Zahra** [6] **and Kamran Ali** [4]

[1]   Department of Conservative Dental Sciences and Endodontics, College of Dentistry, Qassim University, Buraidah, 52571, Qassim, Saudi Arabia; m.anayat@qu.edu.sa (M.Q.J); m.alattas@qu.edu.sa (M.H.A)

[2]   Department of Medical Education, Rawal Institute of Health Sciences, Islamabad, Pakistan; drshazianawabi@yahoo.com (S.N)

[3]   Department of Operative Dentistry, College of Dentistry, Riphah International University, Islamabad, Pakistan. usman.anwer@riphah.edu.pk (U.A.B)

[4]   College of Dental Medicine, Qatar University, QU Health, Doha,2713, Qatar; sundusatique@qu.edu.qa (S.A.); ali.kamran@qu.edu.qa (K.A.)

[5]   Department of Endodontics, Faculty of Dentistry, King Abdulaziz University, P.O. Box 80209, Jeddah, 21589, Saudi Arabia; amahmad4@kau.edu.sa. (A.M.A.)

[6]   Senior Psychometrician, Plymouth University, Faculty of Health (Medicine, Dentistry and Human Sciences), Plymouth, United Kingdom. daniel.zahra@plymouth.ac.uk (D.Z.)

*   Correspondence: m.anayat@qu.edu.sa ; Tel: +966544788659

Abstract: The transition from undergraduate dental student to the actual practicing dentist is a crucial phase and ensuring the preparedness of graduates for the complexity and demands of contemporary dental practice is a challenging task. This study aimed to evaluate the self-perceived preparedness of undergraduate dental students and house officers in the dental colleges of Pakistan. Cross-sectional national study was planned to collect the information from dental students and new graduates in Pakistan. The pre-validated Dental Undergraduates Preparedness Assessment Scale (DU-PAS) was used. Purposive sampling technique was utilized to recruit house officers and undergraduate dental students from 27 dental schools in Pakistan. The data analysis was carried out using the R statistical environment for Windows (R Core Team, 2015). The total of 862 responses with 642 females and 219 males were analyzed in the study. Overall, clinical skills score was 30.56+9.08 and score for soft skills was 30.54+10.6. The mean age of the participants was 23.42+1.28. Deficiencies were reported in various soft skills and clinical skills attributes.The results highlighted the strengths and weaknesses of dental students and new graduates in Pakistani dental institutions. The findings may be used to further develop and strengthen teaching and training of dental students in Pakistan.

Keywords: clinical skills; clinical training; competency; cross-sectional studies; dental education; dentistry; self-perception

1. Introduction

Dental education is an intricate and arduous process that involves taxing pedagogical experience with unique challenges [1]. The ultimate goal of undergraduate dental education is to equip the future dentists with underpinning scientific knowledge, clinical skills and affective skills for safe practice of Dentistry [2]. In addition to clinical operative procedures, dental graduates are expected to exhibit competence in the soft skills that include time management, critical thinking, problem solving, professionalism, leadership, team working and interprofessional collaborative practice [3]. The aim of undergraduate dental education is to produce scientifically proficient and socio-empathic dental practitioners who strive to observe premier standards of ethics and professionalism to serve the society [4,5].

An array of factors influences the quality of undergraduate dental programmes including curricular design; clinical training model; effective alignment of programme learning outcomes with teaching and assessment methods. The conducive learning environment has pivotal role in ensuring effective students' learning [6]. Likewise, teachers are the backbone of an education system and the provision of quality supervision, support and timely feedback by competent clinical teachers can enhance the students' experiential learning [7,8]. Previous research on dental students has identified several areas of weaknesses amongst new dental graduates suggesting dental programmes may not always be able to train the dental students to the expected standards [9-11]. The transition from undergraduate dental student to the actual dental practice is a crucial but challenging step [12]. Evidence from the literature shows that although most of the dental students are adequately equipped to carry out simple operative procedures, they may not be prepared to carry out more complex clinical procedures.4 Considering this, ensuring the preparedness of graduates for the complexity and demands of contemporary dental practice is a daunting task [13]. The dynamic healthcare environment of the modern-day society necessitates to adequately prepare the healthcare professions students, hence, enabling them to follow the evidence-based approaches for the prevention, diagnosis and management of oral diseases [4,13].

The dental faculty evaluates students' work preparedness through continuous formal and informal assessments. Nevertheless, it is important to develop an understanding of the work preparedness as perceived by students themselves [6]. Self-reported preparedness may be an important benchmark to identify the shortcomings in training and to rectify them by encompassing change in curriculum design. Moreover, evaluation of students' self-perceived preparedness may encourage them to practice reflection through self-assessment that can facilitate development of lifelong learning skills [8].

Several studies have explored the self-perceived readiness of the undergraduate dental students in United Kingdom, United States of America, Europe, Hongkong and Malaysia [4,6,12,14,15,16]. Likewise, the studies have been conducted in Pakistan [3,17]. However, previous studies in Pakistan were conducted on a limited sample. The number of dental colleges in Pakistan has increased exponentially since 1990 to meet the increasing healthcare needs of the population [18]. Annually, approximately, 3700 dentists graduate from 18 public sector (1200 students) and 43 private sector dental colleges (2500 students) in Pakistan [19].

The aim of the current national study was to evaluate the self-perceived preparedness of undergraduate dental students and new graduates working as house officers in the dental institutions of Pakistan.

2. Materials and Methods

A prospective cross-sectional National study was conducted at dental schools of Pakistan. Purposive sampling technique was used to recruit house officers and undergraduate dental students (Pre-final year and Final year) at 27 public and private dental schools in Pakistan by using an e-questionnaire. The total population of the students (Pre-final year and Final year) and house officers in 27 institutes was 5112. The acceptable number of responses were calculated as 588 by setting the confidence level at 99% and margin of error at 5%. Raosoft sample size calculator was used (http://www.raosoft.com/samplesize.html). Ethics approval was obtained from institutional review committee (IRC) at Riphah International University, Pakistan (IIDC/IRC/2021/002/006).

The study employed Dental Undergraduates Preparedness Assessment Scale (DU-PAS). DU-PAS is a reliable and validated instrument for measuring a wide range of attributes, competencies and skills expected from dental graduates [20]. The scale has two sections. Section A of scale comprises of 24 items that assess the graduates' competency in the clinical skills. Section B comprises of 26 items focusing on the soft skills including professionalism, cognitive ability and communication skills. Both sections are scored by using a three-point scale as follow. Section A: (0) No experience, and (1) with colleague's practical or/and verbal input, (2) Independently. Section B: (0) No experience, (1) Mostly, and (2) Always. The cumulative score range for DU-PAS is between 0 and 100.

The e-questionnaire (google form link) and participation information sheet were administered at the culmination of academic year. The administration was done through the focal person at each of the 27 dental schools (7 Public and 20 Private) in the WhatsApp groups of third/final year students and house officers. Informed consent was obtained from all the study participants and the potential participants were informed that submission of the response will be considered as their consent to participate in the study. Subsequently, four reminders were given at an interval of four weeks. Data collection process was concluded in five months.

The data analysis was carried out using the R statistical environment for Windows (R Core Team, 2015). Data collection and analysis were completed in six months.

3. Results

3.1. Descriptive Statistics

The total sample consists of 862 responses from across 642 (74.59%) Females and 219 (25.41%) Males, with a mean age of 23.42 years (SD=1.28, Range=20-30). Whilst mean ages were comparable between genders, the distributions varied significantly between Female (Mean=23.32, SD=1.26, Range=20-30) and Male (Mean=23.69, SD=1.31, Range=20-29) respondents (χ (10, n=855) =19.874, p=0.030) – this is depicted in Figure 1.
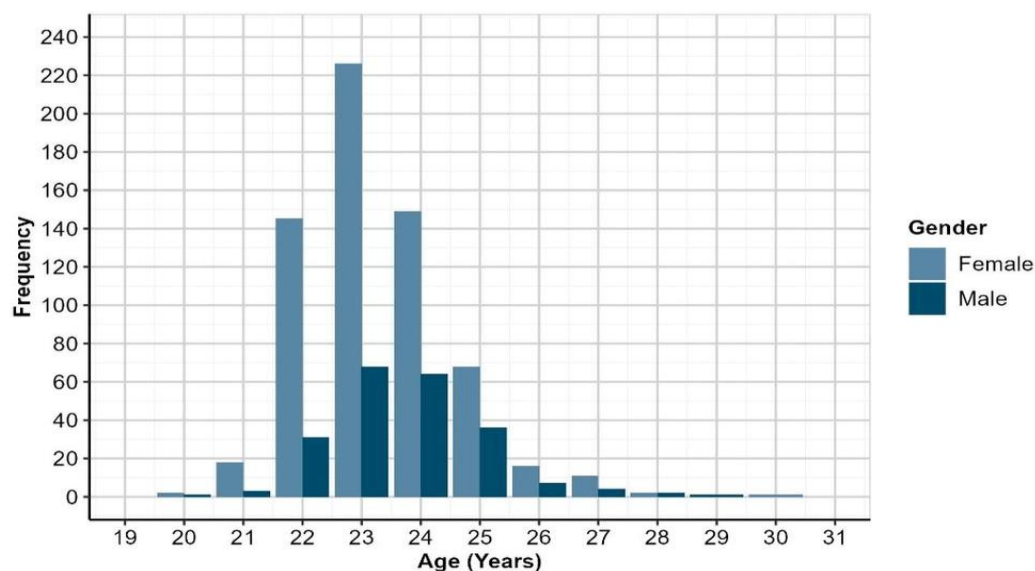

Figure 1. Distribution of Age by Gender.

Of the 862 responses, 581 (67.40%) were received from Private Institutions, and 281 (32.60%) from Public Institutions. In addition, the proportion of Female respondents at private institutions was higher at Private institutions (Female, 22.72% Male) compared to Public institutions (77.28% vs 69.04%; χ(1n=862)=6.36, p=0.012). However, the distribution of Age within Private and Public Institutions did not differ significantly (χ(10,n=855)=15.09, p=0.129). The sample included 507 (58.83%) final-year BDS students (359 Female, 148 Male), 36 (4.18%) pre-final-year BDS students (25 Female, 11 Male), and 319 (37.01%) House Officers (259 Female, 60 Male). Majority of the respondents were from Punjab (n=483, 56.03%), followed by Federal Capital Territory (n=168, 19.49%), Khyber Pakhtunkhwa (n=142, 16.47%), Sindh (n=53, 6.15%), and Baluchistan (n=16, 1.86%).

3.2. Overall Scores

Overall scores by Part are shown in Table 1. These are calculated based on converting responses in Part A (24 Items) and B (26 Items) to numeric scores as; Independently = 2, With Help = 1, and No Experience = 0 (Part A) and Always = 2, Mostly = 1, and No Experience = 0 (Part B).

Table 1. Mean Total Score of Participants.

Part	n	Mean	SD	Min.	Max.	Range	IQR
A (24 Items)	862	30.56	9.08	0	48	48	12
B (26 Items)	862	30.54	10.6	0	52	52	13

3.2.1. Part A Items

By Gender

The responses to each item, by gender, are shown in Figure 2. This figure is ordered from highest to lowest proportion of 'independently' responses, and highlights items for which the response profile differs significantly by gender at the p<0.05 level. These items are also listed in Table 2 along with related p-values.
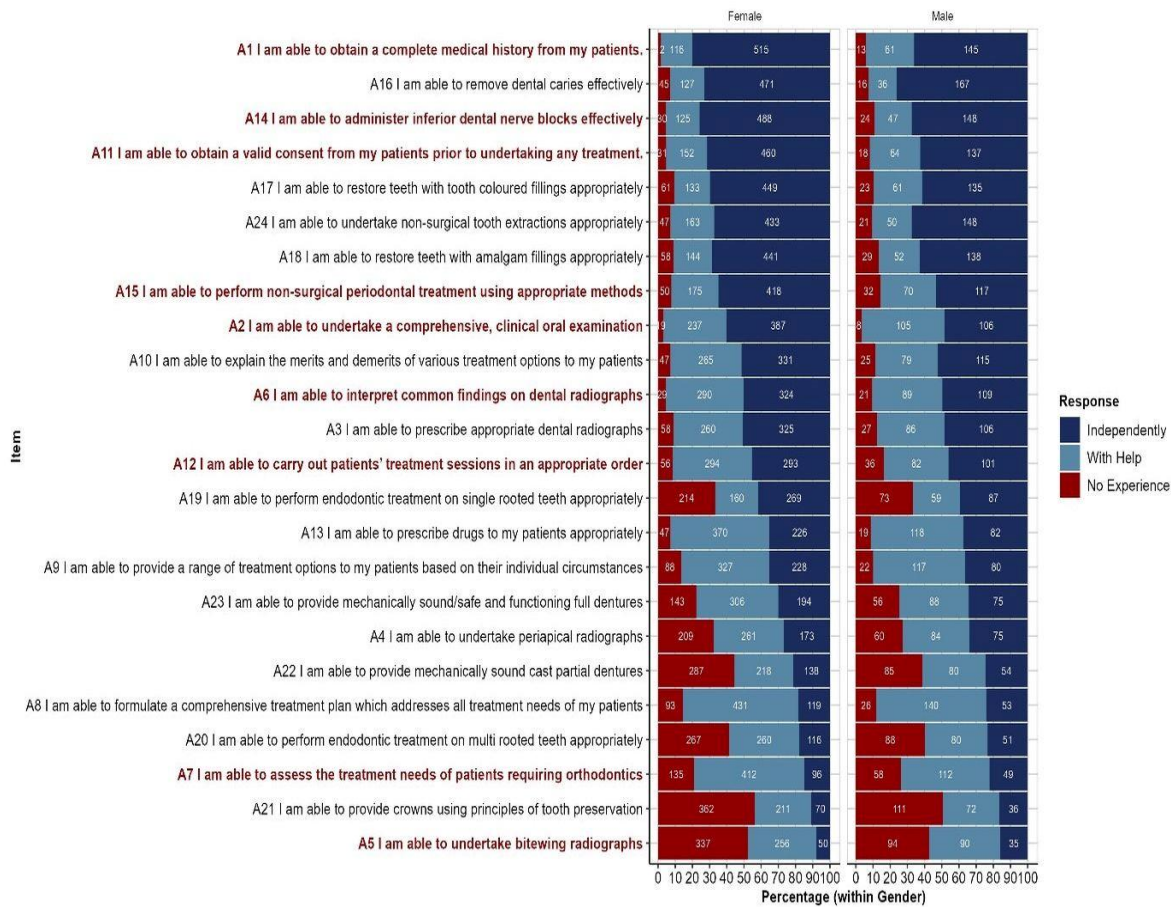

Figure 2. Responses by Part A items (within Gender): Reponses are ordered from highest to lowest proportion of 'Independent' responses (across Genders). Items for which response profiles differ significantly by gender (p<0.05) are highlighted in red bold text.

Table 2. Association between Gender and Item Responses for Part A: Specific p-values from Chi-Squared tests of association for items showing a statistically significant association between Gender and Item Responses for Part A.

Item	p-value
A1 I am able to obtain a complete medical history from my patients.	<0.001
A14 I am able to administer inferior dental nerve blocks effectively	0.002
A11 I am able to obtain a valid consent from my patients prior to undertaking any treatment.	0.027
A15 I am able to perform non-surgical periodontal treatment using appropriate methods	0.002
A2 I am able to undertake a comprehensive, clinical oral examination	0.010
A6 I am able to interpret common findings on dental radiographs	0.018
A12 I am able to carry out patients' treatment sessions in an appropriate order	0.003
A7 I am able to assess the treatment needs of patients requiring orthodontics	0.002
A5 I am able to undertake bitewing radiographs	0.001

By Institution Category

The responses to each item, by Institution Type, are shown in Figure 3. This figure is ordered from highest to lowest proportion of responses reported as "independently", and highlights items for which the response profile differs significantly between Private and Public Institutions (p<0.05). These items are also listed in Table 3 along with the related p-values.
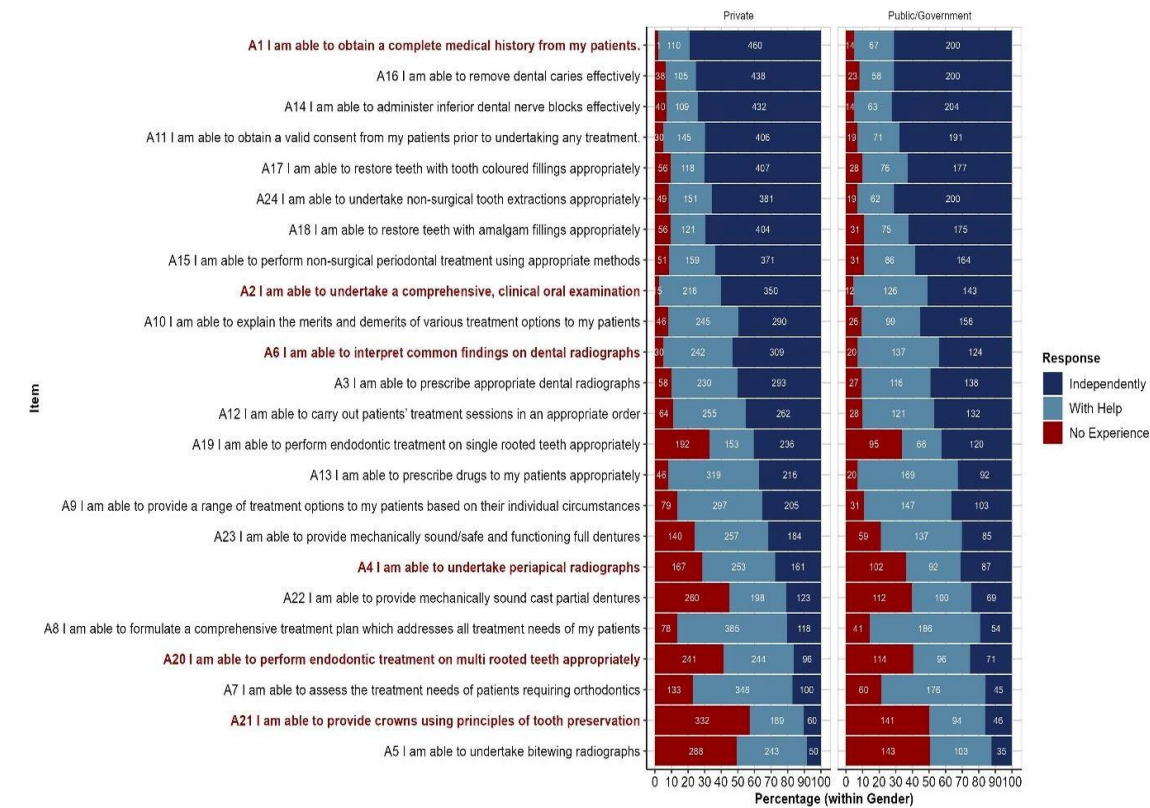

Figure 3. Responses by Part A items (within Institution Category); Responses are ordered from highest to lowest proportion of 'Independent' responses (across Institution Categories). Items for which response profiles differ by Institution Category (p<0.05) are highlighted in red bold text.

Table 3. Association between Institution Type and Item Responses for Part A. Specific p-values from Chi-Squared tests of association for items showing a statistically significant association between Institution Type and Item Responses for Part A.

Item	p-value
A1 I am able to obtain a complete medical history from my patients.	0.007
A2 I am able to undertake a comprehensive, clinical oral examination	0.024
A6 I am able to interpret common findings on dental radiographs	0.039
A4 I am able to undertake periapical radiographs	0.008
A20 I am able to perform endodontic treatment on multi rooted teeth appropriately	0.005
A21 I am able to provide crowns using principles of tooth preservation	0.025

3.2.2. Part B Items

By Gender

The responses to each item, by gender, are shown in Figure 4. This figure is ordered from highest to lowest proportion of 'Always' responses, and highlights items for which the response profile differs significantly by gender at the p<0.05 level. These items are also listed in Table 4, along with related p-values.
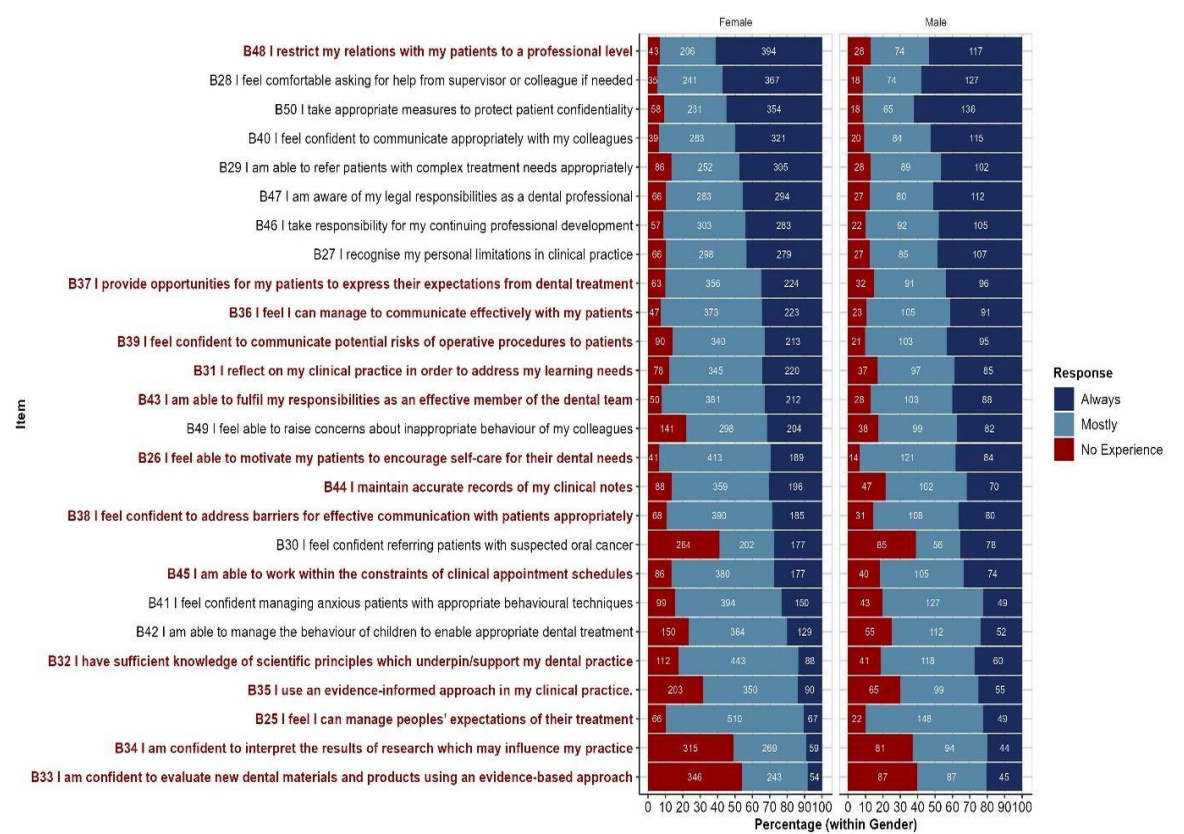

Figure 4. Responses by Part B items (within Gender): Responses are ordered from highest to lowest proportion of 'Always' responses (across Genders). Items for which response profiles differ by gender (p<0.05) are highlighted in red bold text.

Table 4. Association between Gender and Item Responses for Part B: Specific p-values from Chi-Squared tests of association for items showing a statistically significant association between Gender and Item Responses for Part B.

Item	p-value
B48 I restrict my relations with my patients to a professional level	0.010
B37 I provide opportunities for my patients to express their expectations from dental treatment	0.001
B36 I feel I can manage to communicate effectively with my patients	0.028
B39 I feel confident to communicate potential risks of operative procedures to patients	0.015
B31 I reflect on my clinical practice in order to address my learning needs	0.038
B43 I am able to fulfil my responsibilities as an effective member of the dental team	0.003
B26 I feel able to motivate my patients to encourage self-care for their dental needs	0.044
B44 I maintain accurate records of my clinical notes	0.011
B38 I feel confident to address barriers for effective communication with patients appropriately	0.013
B45 I am able to work within the constraints of clinical appointment schedules	0.014
B32 I have sufficient knowledge of scientific principles which underpin/support my dental practice	0.000
B35 I use an evidence-informed approach in my clinical practice.	0.001
B25 I feel I can manage peoples' expectations of their treatment	<0.001
B34 I am confident to interpret the results of research which may influence my practice	<0.001
B33 I am confident to evaluate new dental materials and products using an evidence-based approach	<0.001

By Institution Category

The responses to each item, by Institution Category, are shown in Figure 5. This figure is ordered from highest to lowest proportion of 'Always' responses, and highlights items for which the response profile differs significantly between Private and Public/Government Institutions at the p<0.05 level. These items are also listed in Table 5, along with related p-values.
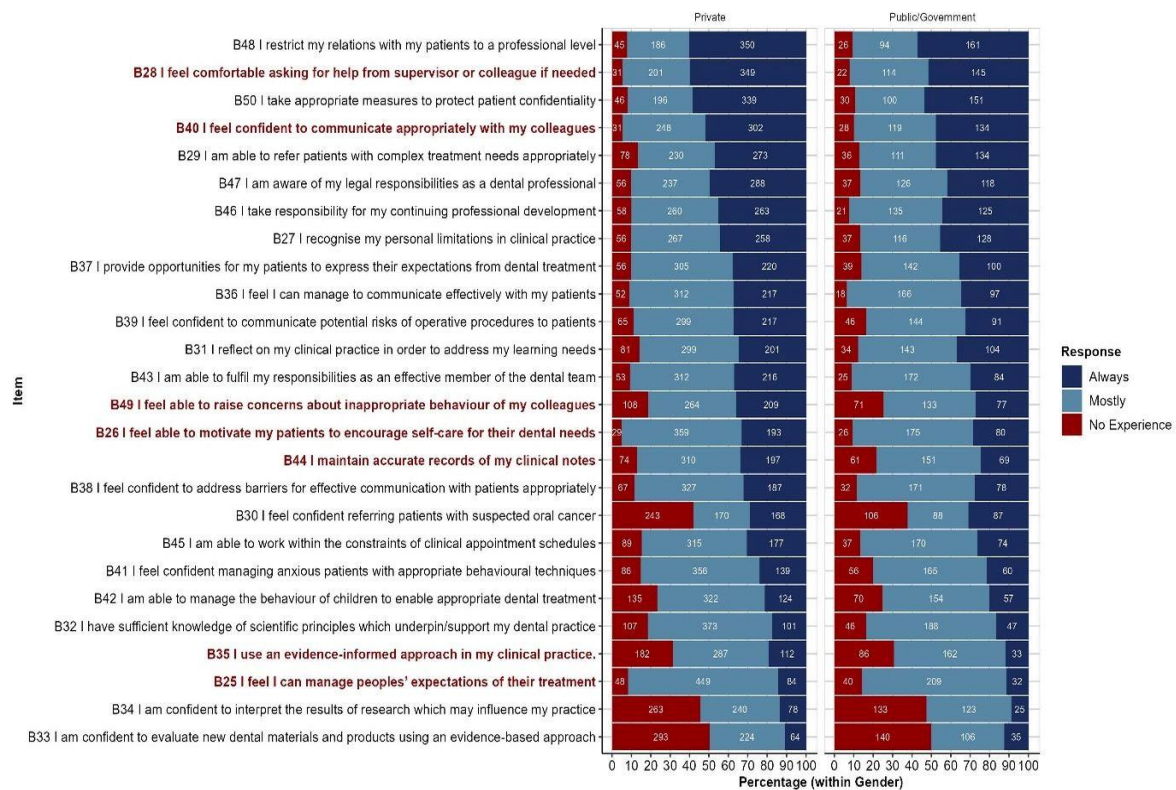
Figure 5. Responses by Part B items (within Institution Category): Responses are ordered from highest to lowest proportion of 'Always' responses (across Institution Categories). Items for which response profiles differ by Institution Category at the p<0.05 level are high.

Table 5. Association between Institution Category and Item Responses for Part B Specific p-values from Chi-Squared tests of association for items showing a statistically significant association between Institution Category and Item Responses for Part B.

Item	p-value
B28 I feel comfortable asking for help from supervisor or colleague if needed	0.047
B40 I feel confident to communicate appropriately with my colleagues	0.036
B49 I feel able to raise concerns about inappropriate behaviour of my colleagues	0.015
B26 I feel able to motivate my patients to encourage self-care for their dental needs	0.034
B44 I maintain accurate records of my clinical notes	0.001
B35 I use an evidence-informed approach in my clinical practice.	0.012
B25 I feel I can manage peoples' expectations of their treatment	0.017

4. Discussion

This is the first national study reporting self-perceived preparedness dental students and new graduates from multiple private and public sector dental institutions in Pakistan.   The study provides useful insights into the preparedness of dental students and graduates from Pakistan and highlights several areas of weakness which warrant attention and remedial measures by dental educators in Pakistan.

Based on the total mean score of the study respondents, dental undergraduates of Pakistan reported to be less prepared (mean score 61.10) compared to dental students from other countries like Malaysia (79.5%) and the United Kingdom (74%) [4,14].

In the present study, respondents felt most prepared to record medical history, remove dental caries and administer inferior dental nerve blocks. Similar findings were reported by other studies investigating students from not only Pakistan but also the United Kingdom [3,14,17]. Considering

these are generally straightforward, it is not surprising to find this similarity among students of developing and developed countries.

Regarding areas of deficiency in clinical skills, experience in performing endodontics was observed to be deficient and respondents from both private as well as public sector institutions reported a lack of experience in performing endodontic treatment on multi rooted teeth (61.1%) and also single rooted teeth (33.3%). In contrast, Ali et al., reported only that only 2.4% of dental students in the UK did not have any experience of carrying out endodontic treatment on single rooted teeth [14]. Moreover, with respect to the endodontic treatment of multi rooted teeth, a significant difference was observed in the preparedness of respondents from private sector compared with those from public sector. These differences are quite remarkable and highlight the need for further clinical experience in endodontics for dental students in Pakistan [21].   Interestingly, developed countries face a similar challenge in undergraduate endodontic education [22,23].

Radiography skills were also flagged up as a relatively weak area in the present study. Respondents of the present study were least prepared to taking bitewing radiographs in contrast to participants from the UK and Malaysia [4,14]. Qazi et al reported a similar lack of confidence in performing bitewings among Pakistani students in contrast to students from Malaysia and United Kingdom [4,14,17]. Anecdotal evidence suggests that dental students in Pakistan do not get adequate experience in bitewing radiography. Instead, there is a preference for using periapical radiographs to diagnose dental caries which is inappropriate. These findings underscore the need to revisit radiology teaching and align it with contemporary and evidence-based clinical practice.

Other areas of reported weakness include assessment of orthodontic treatment needs; provision of crowns and, fabrication of cast partial dentures. These findings concord with those reported by with Qazi et al, Ali et al and Mat Yudin et al, who reported similar challenges for students in Pakistan, United Kingdom and Malaysia respectively [4,14,17]. More importantly, however, there was a significantly high proportion of participants in this study who reported "no experience" in these skills. Given these are core skills expected from a general dental practitioner, these findings raise serious concerns regarding the breadth of clinical training in Pakistani dental institutions. The present study has managed to capture the magnitude of these deficiencies in clinical skills which was not achieved in a previous study on a relatively smaller study sample.

Majority of the respondents felt prepared to communicate with the patients, seek help from supervisors, protect patient confidentiality among other attributes of professionalism. These observations are positive and demonstrate a professional and ethical culture in educational and clinical settings. However, the participants felt less prepared regarding interpretation of research to inform their clinical practice, evaluation of dental materials/ products using an evidence-based approach and, the referral of patients suspected of oral cancer. Similar observations have been reported in previous studies on preparedness of dental students and new graduates [3,14,17]. Understanding and application of evidence-based dentistry in undergraduate dental education remains a challenge globally despite the growing emphasis on its importance in the last two decades [24]. In the absence of a structured course on evidence-based dentistry in undergraduate dental curricula in Pakistan, the findings are not unexpected. Dental institutions in Pakistan need to develop a comprehensive strategy to incorporate principles of evidence-based dentistry in undergraduate curricula [25,26]. It may be helpful to learn from experiences of dental institutions in the West who provide teaching on evidence-based practice to make informed decisions on updating existing dental curricula in Pakistan [27,28].

Given that Pakistan has one of the highest global incidences of oral cancer, it is ironic that Pakistani dental students and graduate feel unprepared to recognize and refer suspected oral cancer. This may be related to lack of consistencies in the teaching and clinical exposure to patients with oral cancer.   Early detection and prompt management of oral cancer is most critical in improving cancer survival rates and reducing cancer-related morbidity and mortality [29]. Unfortunately, a similar lack of preparedness was identified in other countries like the United Kingdom and Malaysia [4,14]. Structured exposure to oral cancer patients in specialist oral and maxillofacial surgery settings is essential to improve students' confidence in recognition and referral of oral cancer.

The data also highlighted several gender-related differences in self-reported preparedness. Female students felt better prepared in history taking, clinical examination, radiographic interpretation, treatment sequencing and non-surgical periodontal treatment. On the other hand, male respondents reported better prepared to assess orthodontic treatment needs, and bitewing radiography. Other notable differences related to affective skills as female respondents felt more prepared to maintain professional relationship with patients, effectively communicate with patient and reflect on their clinical practice. A similar gender-related disparity is observed in other studies, with the female students reported to demonstrate better empathy towards patients compared to male students [30]. In contrast the male respondents felt more prepared to interpret research for clinical application and evaluate materials using an evidence-based approach. However, contrary to the evidence indicating a lack of confidence among female undergraduate dental students, findings of our study show female students as more prepared than male students in terms of clinical skills and professionalism [12,30]. These differences may be attributed to a higher proportion of females in the study sample and perhaps also to growing female empowerment in the society [31,32].

Finally, differences were also noted between participants from private and public sector institutions. Participants from private institutions felt better prepared in attributes related to professionalism which may reflect cultural differences in private and public sector institutions. Also, Public sector institutions face a much higher inflow of patients. Increased workload and time constraints may impact adversely on novice clinicians' interpersonal skills, although this cannot be justified and needs remedial action.

The preparedness for practice is a complex concept, which can be studied through the perspective of academicians, students, dentists, and patients [33,34]. In this study, preparedness of a large sample was measured from a student's perspective using a validated tool which contributes to an improved internal and external validity. However, caution may be exercised while interpreting self-reported preparedness by dental students as the scores may be inflated by "unconscious incompetence" or a lack of experience in self-evaluation [35,36]. Evidence regarding correlation between actual clinical competence and perceived self-confidence is weak [37]. Nevertheless, the overall mean scores of participants in this study appear to be lower than those reported in previous studies from the UK, Malaysia, and Pakistan which also used the DU-PAS instrument. These differences may underscore "conscious incompetence" amongst the participants in this study or a genuine lack of preparedness. Another factor which may have contributed to the lower mean scores of the study participants might be related to inclusion of Pre-final year students who had less experience. It is also worth-emphasizing that the study was conducted following the start of the COVID-19 pandemic, and it is possible that the lower level of preparedness reported by the study participants may reflect the adverse impact of the pandemic on their teaching and training [38,39,40]. Dental institutions must ensure that appropriate checks are in place to monitor the quality of their graduates and support is available for new graduates to address any gaps in clinical experience. The implementation of reflective learning with feedback in undergraduate Pakistani curriculum can be a step towards improving the self-perceived preparedness of clinical skill [41].

5. Conclusions

This study investigated self-reported preparedness of a large sample of Pakistani undergraduate dental students and new graduates using a validated instrument. The results highlight the strengths and weaknesses of dental students and new graduates in Pakistani dental institutions. The findings may be used to further develop and strengthen teaching and training of dental students in Pakistan. The findings may be of interest to dental educators in Pakistan and further afield. DU-PAS appears to be a reliable instrument to quantify preparedness of dental graduates from different parts of the world. In future mixed methods research involving qualitative methods may be employed to engage with a range of stakeholders in dental education. Such an approach may help gain a deeper understanding of the factors which influence the preparedness of dental students and the role dental institutions can play to improve the learning experiences of the students.

Institutional Review Board Statement: The study was conducted in accordance with the Declaration of Helsinki and approved by the local committee for bioethics, institutional review committee (IRC) at Riphah International University, Pakistan (IIDC/IRC/2021/002/006).

Informed Consent Statement: Informed consent was obtained from all the study participants and the potential participants were informed that submission of the response will be considered as their consent to participate in the study

Data Availability Statement: Data will be made available upon request

Conflicts of Interest: The authors declare no conflict of interest.

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