DENTISTS KNOWLEDGE ATTITUDE AND PRACTICE FOR PREPARING A SOUND MAXILLARY PREMOLAR FOR A FIXED DENTAL PROSTHESIS

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ABSTRACT

Objective: *To asses the effect of education and experience on the knowledge, attitude and practice (KAP) of dentists regarding various aspects of tooth- preparation of maxillary second premolar to receive a metal-ceramic full-coverage retainer of a fixed dental prosthesis.*

Material and Methods: *During the period of May 2005 to April 2006 and using a structured questionnaire, data was recorded from dental practitioners working in two cities. The participant dentists as well as their KAP data relating to tooth preparation for the test retainer on maxillary second premolar were collected. Practitioners filled questionnaires by selecting from the given statements. Data from 120 practitioners divided into 4-groups, on the basis of their educational background and clinical experience were collected.*

Results: *Practitioners KAP was considered acceptable relating to tooth preparation parameters set for the occlusal surface (81%) and depth (73%), surface-topography (78%), taper (72%), and palatal reduction depth (60%). Poor responses for the statements for the finish-line location (52%), shoulder-form (36%), labial reduction depth (51%), use of retraction-cords (39%) and metal-framework trial (45%) were recorded. In general, the KAP of fresh-graduates was found better.*

Conclusion: *While most practitioners possessed acceptable level of KAP regarding the tooth preparation design and trial of metal-coping, there were still some areas in which they lacked desirable knowledge.*

Key Words: *Fixed dental prostheses, tooth preparation, dental practice, KAP.*

INTRODUCTION

Among the many available restorative options, the metal-ceramic (MC) fixed dental prostheses (FDPs) have demonstrated not only a higher long-term clinical success rate but they are also considered as the standard treatment modality for replacing missing teeth[11-14]. The 3-unit fixed-fixed design FDP with complete retainers on abutments at each end of the bounded saddle has shown a favorable prognosis for the single missing tooth such as a maxillary molar[15]. Dental practitioners and patients both consider FDP as the treatment of choice for replacing the missing tooth / teeth because of their good long-term success predictability, reliability, cost-effectiveness and psychological advantages even in the developed countries including USA[16, 17]. In case of MC-FDPs, an insufficient tooth preparation will subsequently lead to an insufficiently or an overly thick porcelain layer on the metal-sub-structure. Hence the resultant inferior aesthetics may limit its use. Despite all these, the application of MC technology in FDPs has remained the aesthetic standard not only in UK but all over the world. This is mainly because MC-FDPs have both the mechanical strength and aesthetic qualities[18-22]. In case an MC-FDP of fixed-fixed design is to be used to replace the missing maxillary first molar, tooth preparation on the maxillary second premolar will be carried out for use as a prospective mesial-abutment. Maxillary premolars because of their

INCLUSION AND EXCLUSION CRITERIA FOR DENTISTS TO PARTICIPATE

Inclusion Criteria:
Having PM&DC registerable qualification.
Actively involved in dental practice and providing FDPs to patients.
Having an independent dental practice.
Exclusion Criterion:
Dental House Officers undergoing house job training.

Table 1

relatively more proximal location in the dental arch are more visible teeth as compared to molars. Therefore, meticulous attention is required when preparing, designing and placing restorations on them. Consideration of these will facilitate an aesthetically pleasing and functionally efficient restoration[23].

During undergraduate training and studies, dental students including internees do not master the skills and experience of tooth preparation. There are many reasons for this including a general dislike of patients to be treated by a trainee student and the feeling and apprehension of a student to apply a learning experience focused on the dimensions of rotary instruments rather than tooth morphology[24-26]. In this country the MC technology has very recently become popular despite this having been introduced for more than 50 years. Many dentists practicing today who were trained before the early 90s had been provided little if none of the theoretical and practical instruction during their training about the MC technology and its clinical guidelines. What they might know about the technology and biological aspects of the MC FDPs could be a consequence of their own learning experiences and interests. Furthermore, many dentists often do not pay greater attention to the tooth preparation phase probably firstly, because of having limited chair-side time and secondly, they think it will be covered up by the restoration. This is despite a fact known to them that fixed prosthodontic procedures require care, skill and judgment specifically in term of a quality tooth preparation[27,28]. In fact the quality of the abutment preparation has been considered as one of the most important factors for the success of the prostheses requiring the use of clinical skill[29-30]. It has also been shown that despite the availability of tooth preparation guidelines for complete crowns, they had been seldom applied exactly[31]. Tooth preparation being an important step in the fabrication of metal-ceramic restorations needs meticulous attention. As an example, to fulfill the biological consideration, the finish-line should preferably be placed supra-gingival, with a 90-degree butt-joint shoulder. A search of the literature will reveal several articles and references explaining and emphasizing on the various parameters of tooth preparation and FDP design procedures and principles[23,29,31–42].

Having understood the situation, the present study is designed to assess the knowledge, attitude and practice (KAP) of a group of local dental practitioners with varying levels of educational and clinical experience regarding the tooth preparation design of a maxillary second premolar to receive a full coverage metal-ceramic

DENTISTS (%) EXPERIENCES RELATED TO FDP PRACTICES

Extent & Involvement FDP practices	Group I (%)	Group II (%)	Group III (%)	Group IV (%)	All (%)
1. > 30% practice time devoted to FDP making.	33.3	40.0	20.0	20.0	28.2
2. Making more than 50 FDPs / year.	33.3	40.0	20.0	33.3	31.7
3. Giving prescriptions to laboratory for FDP Design.	90.0	66.7	83.3	60.0	75.0
4. Having received additional training in FDPs	26.7	26.7	93.3	06.7	18.3

Group I *= Specialists, Group II = Basic Dental Qualification + > 10-years Clinical Experience,*

Group III *= Basic Dental Qualification + 5 -10 years Clinical Experience,*

Group IV *= Basic Dental Qualification + up to 5-years Clinical Experience.*

Table 2

GOOD ASPECTS OF TOOTH PREPARATION PRACTICED BY DENTISTS (%)

Following good aspects of tooth preparati	Group I (%)	Group II (%)	Group III (%)	Group IV (%)	All (%)
1. Following natural occlusal surface anatomy.	73.3	73.3	93.3	86.7	81.7
2. Ensuring walls blend smoothly with each others.	76.7	80.0	73.3	83.3	78.3
3. Locating finish-line supra-gingival.	43.3	50.0	46.7	70.0	52.5
4. Shoulder with 90° butt-joint.	33.3	30.0	36.7	46.7	36.7
5. 2 - 2.5 mm reduction of occlusal surface.	86.7	76.7	83.3	93.4	85.0
6. 2 - 2.5 mm reduction of labial / buccal surface.	55.7	36.0	50.0	50.0	48.9
7. Lingual surface prep less than the buccal surf.	62.3	60.0	53.3	63.7	60.0

Groups details as given in Table 2. Table 3

restoration or retainer. The data collected will help in providing information about the situation that will be used as a starting point for planning and re-directing our educational training and professional development programs in this particular field. The end result is to help dentists provide cost-effective services to patients.

MATERIAL AND METHODS

A cross-sectional comparative study was conducted from May 2005 to April 2006. It was designed and initiated at the Department of Prosthodontics, Khyber College of Dentistry to collect data from 120 dental practitioners with varying levels of professional experience. They were equally divided in four groups (30 in each) on the basis of their levels of professional experience, and education. Group I comprised of dentists with specialist qualification in any dental specialty. Group II comprised of practitioners with basic dental qualification and an active professional experience of more than 10-years. Groups III and IV both comprised of dentists having basic dental qualification, but an experience of not more than 10 and 5 years respectively. Data from 30 dentists in each of the above 4-groups were collected. Their inclusion and exclusion criteria are given in Table 1.

Data were collected using a structured questionnaire comprising 17 statements elaborating the extent of involvement and interest of dentists in practices related to fixed prosthodontics. These pertained to the following or otherwise of the good practices of tooth preparation and other practices ensuring or enhancing FDP quality. The questionnaire first documented the qualification of dentists, numbers of years spent in active dental practice, extent and interest of involvement in the provision of FDPs to patients. It also recorded information about any training or workshop attended on FDPs. Its second part, facilitated to know about, through recording of responses to various statements covering various aspects of tooth preparation. These tooth preparation aspects included the occlusal surface morphology, finish-line location and its geometry, retraction cord placement, trial of metal framework, axial surfaces reduction depths etc, on a sound and virgin maxillary second premolar for a full-coverage metal ceramic FPD retainer. In the majority of cases, two response items were given to each stem, one being correct or more acceptable than the other. The participant's identity as well as their data remained confidential.

%AGES OF DENTISTS FOLLOWING PRACTICES ENHANCING FDP QUALITY

Practice aspects enhancing FDP quality	Group I (%)	Group II (%)	Group III (%)	Group IV (%)	All (%)
1. Preparing proximal surf by starting cutting within the enamel thickness & carrying it apical.	56.7	40.0	53.3	50.0	50.0
2. Incorporating adequate taper in the preparation.	83.3	66.7	70.0	70.0	72.5
3. Using gingival retraction cords.	50.0	43.0	30.0	33.3	39.2
4. Practicing advanced methods for checking inter-occlusal clearance.	23.2	22.9	26.4	13.1	19.1
5. Routinely trying-in the FDP Metal framework.	56.7	43.3	40.0	40.0	45.0
6. %age of correct responses given.	59.4	56.4	56.4	61.0	58.3

Groups details as given in Table 2. Table 4

The data collected was analyzed using the Statistical Package for Social Sciences (SPSS) Version 10. Frequencies were computed for practice related data like prescription to laboratories about the FDP design and participation in additional training / workshops as well as for the data regarding the tooth preparation and other FDP practice aspects. Chi-square test was applied to data to see the level of significance of the association between the experience and education / specialization with the answers / responses to various statements. The level of significance was set at $p<0.05$.

RESULTS

Data were collected using 150 questionnaires distributed among practitioners. Some questionnaires (N = 130) were distributed personally, while 20 were sent by postal mail. Of those sent by mail, 12 were received by post while 108 were collected personally. This gave an overall response rate of 80%. The male dentists outnumbered the females (3.1: 1.)

The FDP good practice aspects of dentists are given in Table 2. In this table, one could see the proportions of dentists giving more than 30% of their practice time to FDP making. The extent of their involvement in FDP related work is also evident. Similarly, the proportions of dentists giving prescriptions to laboratories regarding FDP design and the proportion of those having received additional training related to fixed prosthodontics is also shown. Apparently, variation of proportions of dentists in the various groups for these aspects of FDPs can be seen in this Table. However, in general, it is satisfying to see that a great majority of dentists had acceptable FDP practicing trends and attitudes. It is also clear that the between groups differences of the proportions of dentists for any of the aspects related to FDP practice were insignificant.

Table 3 details the proportions of dentists following some good and important aspects pertaining to tooth preparation. One can see that some of these good tooth preparation aspects were known or followed by a large proportion of dentists of a particular group. Even for some of these, many were knowledgeable irrespective of the group they belonged to. In this Table, it is however, surprising that a great majority of dentists belonging to any group were not following the recommended form of the shoulder preparation. The variations of data pertaining to the occlusal surface preparation were found to be significant for dentists belonging to group III than that for Group I and II ($x^2 = 4.320$, $p = 0.04$). For the other tooth preparation aspects, however, the observed variations remained insignificant showing no effect of the length of clinical experience or of specialization.

Table 4 details the data for the good FDP practices of dentists that will enhance the quality of the FDP. Again great variations in the data for each of these aspects could be seen both within a group and between groups of dentists. The observed data variations between the various groups, however, remained insignificant. ($x^2 = 1.867$, $p = 0.6$).

The participants were also asked to point out two methods they would prefer from among the many available for the assessment of the appropriateness of the amount inter-occlusal space / clearance. In this regard 27.5% dentists were visually assessing the inter-occlusal space. The wax method alone was being used by 5% of the respondents while another 3 dentists were using only probe for this purpose. Most of them knew more than one method. The visual and wax or visual and probe method was used by 32% and 19% respectively. A significant difference was observed between the general dental practitioners having experience more than 10- years and practitioners of up to 5-years experience.

Table 4 also shows satisfactory proportions of dentists favouring the incorporation of some taper or total occlusal convergence (TOC) within the preparation. The trend for this was consistent among the participants of all four groups with the observed variations remaining insignificant. In Table 4, the proportions of dentists in some groups, using gingival retraction cords prior to recording the impression was not as expected. Generally some 61% dentists were not using retraction cords at all. Between groups, the differences were insignificant. Irrespective of their group, less than half of the dentists (45%) were asking their laboratories to send the FDP metal framework for a trial in the patient's mouth (Table 4). The tendency for this was highest (56.7 %) among dentists in group I who were specialists.

Similarly, at the trial stage, various aspects of the metal framework can be seen and observed. These include the assessment of marginal fit, tightness of the restoration and most importantly the thickness of the metal framework. Furthermore, assessment of the space available for the veneering porcelain will also be done. Different practitioners responded differently to this question. Some 61% did not respond to the trial of FDP metal-framework. Some 10% were to check for clearance of the metal framework from the antagonist occluding teeth. The rest of dentists liked to see more than one aspect in the metal framework trial.

For example some 10% preferred to see marginal fit along with the occlusal clearance.

The overall correct responses recorded for all the statements were 58.3%. Looking at these data for each of the individual groups, in Table 4, it appeared that the majority of correct responses (60%) came from dentists relatively freshly graduated (Group-IV). While dentists in group II and III gave equal proportions of correct responses (56%) as compared to 59% by specialists in group I. However, none of the differences so observed were statistically significant (x^2=2.103, df = 3, P = 0.6).

DISCUSSION

The interest of dental practitioners in this study can be judged from their response rate of 80%. This is even higher than a previous study of the kind done locally[33]. Evaluation of their KAP regarding tooth preparation design was necessary for measuring the quality of service they render to patients. This was also necessary to identify areas of concern and the need and ways for improvement. For this purpose a KAP study was the need of the hour. If such strategies are followed in true spirits, the ultimate beneficiary will be the patient to have a cost-effective treatment. Moreover the clinician and technician will be able to deliver the best services.

There might be few limitations of this work. A bias in information might be suspected because of possible consultation for answers among the participating dentists. However, from the varying pattern of the data, the evidence for bias is scarce. Secondly, data from a limited number of participating practitioners from one province may not be reflective of provincial or national situation of the practitioners KAP. It is worth mentioning that currently there are 1278 dentists in NWFP and 8169 dentists in the country registered with the Pakistan Medical and Dental Council (PMDC)[43]. Therefore, future studies should consider inclusion and participation of a larger number of dentists for better reflecting the real situation. The present study encompassed not all but probably some most important aspects of preparation of the abutment tooth used for the FDP retention and support.

The percentage of practice time spent on FDP making by dentists in this study is almost analogous to that observed in previous studies[44-45]. It shows that now dentists are involved in providing more FDP services to patients, confirming the ever-increasing changing trend towards FDPs. This finding is in line with the number of FDPs provided by them per year. 66% dentists provided more than 20 FDPs per year. This finding correlates well with those of previous local studies that showed reduced removable partial denture (RPD) related work-load of dentists as compared to their FDP work-load[44- 45].

Two-third (75%) of the dentists were routinely sending, to the laboratories, written instructions relating to FDP design (Table 2). This certainly shows a positive attitude of dentists in this study as compared to the observation of another study of the kind[44]. The high percentage of dentists giving written instructions to laboratories as seen here might be related to description of the shade of restoration. The observed trend among the given groups (I, II, III, and IV) was 90%, 66.7%, 83.3% and 60% respectively.

A very important point of concern to note was that only some 18% dentists had attended additional training or workshop (Table 2). This indicates that majority of them remained deprived of continuing professional development (CPD) facilities in one way or the other. This is a situation that highlights the need for such professional development courses. These courses organized by individuals or groups are already available but practitioners think of them as time-consuming or expensive. There is thus a need for these to be arranged by the public sector institutes and organizations.

Preparation of the occlusal surface is considered more appropriate if the normal occlusal surface morphology is followed and its contour retained[33-34]. This will ensure a restoration with even thickness and will reduce the risk of pulp exposure. A great majority of dentists correctly responded by selecting the statement of 'following the occlusal surface morphology" (Table 3)

Sharp meetings of walls making angles and sharp cusp tips adversely affect the final fit and life of the restoration. Therefore these on the prepared tooth should be smoothly blending with each other[35]. This was correctly responded by more than 2/3 of the dentists. Majority of these were belonging to group-IV (Table 3). This may be a reflection of improved teaching and higher level of motivation for learning among the relatively younger participants.

Location of the finish-line is important both in the context of health of the tooth-supporting tissues and aesthetics. Profound evidence is available for the supra-gingival finish-line location of the preparation[42]. Only 52.5% of the dentists knew or practiced this. This healthy practice was mostly followed by dentists in group-IV (Table 3). The finish-line for metal-ceramic retainer / restoration should have a 90-degree butt joint shoulder. This has many advantages as

compared to the beveled shoulder[36]. The practice of dentists that was prevailing was quite poor regarding the preparation of the tooth for this particular aspect for the FDP designing (Table 3).

An appropriate amount of the occlusal and buccal surfaces reduction is necessary to have a restoration with optimal properties, if occlusal surface is to be covered with porcelain that is 2 mm is a safe side[23,29,35]. Practitioners in Group IV and Group II gave more correct responses for the occlusal and buccal surfaces reduction depth (Table 3).

The palatal surface needs to be minimally prepared in comparison to the rest of the surfaces such as the occlusal and buccal surfaces [37]. Some 60% dentists knew about the required depth of the palatal surface and the fact that it should be less than the buccal surface of the same tooth (Table 3). The trend observed was consistent among the dentists in all the four groups. Similarly, it is important to avoid damage to the adjacent tooth surfaces while the proximal surface of the tooth is being prepared. A suitable method to ensure this is to start the preparation over the occlusal surface and carry it down apical-ward[23]. This will leave a fine sliver of enamel between the bur and the adjacent tooth surface. As only half of the participants chose this, it means that there is still more room for improvement (Table 4).

Various methods are available for the assessment of required occlusal clearance. Those who used or stated two or more methods for this assessment were better as compared to those using only one method. 27% practitioners only used the highly subjective method of visual assessment with naked eye of the inter-occlusal space as compared to other methods giving more accurate and objective assessment. A note-worthy aspect was the use of probe for this method, the type of which they did not mention. Surprisingly, most dentists were not using the most recommended objective and accurate method of the impression silicone index [38]. This might reflect problem of access to published new research and their recommendations or probably the practitioners were lacking interest or they felt too busy in doing clinical work. An ideal approach would have been to organize their practice schedule and leaving time for reading up to date knowledge or knowing about it through participating in professional development programs.

Taper is an important feature of the tooth preparation that needs meticulous attention if the making of a restoration with optimal resistance is the goal [39]. Over-tapered tooth preparations decrease the life span and success of the prostheses. In the present study 72.5% of the participants were aware that taper was to be given to the preparation. There were still others who were in favor of not giving any taper to the preparation (Table 4). As no precise extent of the taper in terms of degrees that the preparation should have was given to them, just the incorporation of taper was surely not a precise answer. These aspects would need another study for evaluation. Of the many methods of assessment of parallelism of axial surfaces, unfortunately none are regularly used in the clinical practice. Practitioners apply only the direct viewing technique or inspection of the preparation. Mostly, better assessment would be expected if they had gathered knowledge, experience and skills over the years. Experience and practical clinical exposure to the management of problems / causes for loss of retention of FDPs including crowns could provide them awareness to the importance of the desired extent of taper or total occlusal convergence (TOC).

Gingival retraction is important to provide exact details of the prepared surfaces to the laboratory as for as the finish-line is concerned [40]. This study found that more than 60% of the participants did not use gingival retraction cords or procedures (Table 4). This trend was found in almost all of the groups consistently (Table 4). It was also found that of the 39% dentists using the gingival retraction, only 27 / 120 mentioned about the widely varying methods of gingival retraction. The rest of them were not able to mention any method at all. It can be assumed that they either did not know the exact and accurate method of gingival retraction cords application or did not have enough time to apply the same.

Before the finished restoration is cemented on to the preparation, it is quite necessary to remove / rectify shortcomings if any at the trial stage, by checking the metal framework[40 - 42]. Not doing so could increase the chances of remaking of the FDP or the need for corrective modifications.[41]. A very discouraging trend was observed because even less than 50% of practitioners did not take advantage of the trial stage (Table 4). Among the dentists in various groups only 56% belonging to the specialist group were asking their laboratories to send metal framework for its trial in the patient's mouth. Any shortcoming that may come across at the trial stage must be rectified. Majority of participants (61%) did not respond to the statement regarding the various aspects to be seen at the trial stage while only 10% liked to see the clearance from the tooth/ teeth in the opposing arch mainly for the veneering porcelain.

This study showed that all the practitioners irrespective of their specialization or

the length of clinical experience had rather poor knowledge of some aspects of tooth preparation... This emphasizes on the need and room for improvement of concerned prosthodontic procedures. Surprisingly in the study conducted, relatively inexperienced practitioners belonging to Group-IV with up to 5 years experience were found as a whole more knowledgeable on the subject. This substantiates the finding of other studies done locally[44-45]. The most probable explanation for this might be that dentists in this groups possessed better knowledge on the subject because of their more interest to access current research based topics on the internet, and text and research references. The overall better performance of these practitioners may also be attributed to the recent utility of improved teaching methods and facilities in the teaching hospitals and institutions. Because of the many new dental schools and departments opened, during the past 10-years or so, in both the public and private sector, a substantial proportion of the currently 8169 practicing dentists in Pakistan could be considered as those belonging to Group IV dentists of this study[43]. This might indicate they will have a better KAP and could provide effective FDP services. However, this extrapolation for the KAP of dentists in this group would certainly require more research in the event that recent local studies have shown substantial and early post-fitting clinical and technical problems in fixed dental prostheses including crowns[46-48].

It is interesting to see that general dental practitioners belonging to group-II and group-III with more than 10-years experience and those having experience between 5 to 10 years respectively were found exactly at equal levels by giving relatively smaller number of correct responses (56.4%)) as shown in Table 4. This poor performance may be linked with their lack of interest for gaining up to date and fresh knowledge. Practitioners of group-III having experience between 5-10 years also showed a poor performance. Although by virtue of having rather fresh knowledge as well as experience they were expected to perform better in this regard. However the situation was not so as one would have expected. The possible reason might be their lack of interest in applying their relatively fresh knowledge by avoiding time-consuming procedures like application of retraction cords, trial of metal framework, accurate assessment of inter-occlusal clearance by suitable materials and so many other procedures. Though it was expected that specialists would perform better but they were found second to group-IV practitioner in performance. The most probable explanation for this might be their specialization in the fields other than the discipline of prosthodontics.

This study highlights clear gaps in the practicing environment and situation that is prevailing. This has been the focus of research and discussion in many studies conducted not only locally[44-47] but also worldwide[24-29,31]. Despite the fact that many research and review articles and books recommend that the proposed guidelines need to be followed, they are seldom reflected as a skill and practice and practice attitude in clinical scenario. This has been termed as a disparity between the fixed prosthodontics teachings and its application in true spirit[31]. Some investigators have termed it as negligence on the part of practitioners[28]. Still some emphasize the need for improvement not even at the undergraduate level but at the internee's level, as well[29]. It may be concluded that greater attention needs to be focused on training dentists at various levels. Active participation in advanced level courses including refresher courses, workshops and trainings could prove valuable in keeping clinical practitioners to remain current. Only then they will be able to deliver best services to patients.

CONCLUSION

While most practitioners possessed acceptable level of KAP regarding the tooth preparation design and trial of metal-coping, there were still some areas in which they lacked desirable knowledge.

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