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Official Publication of Istanbul University Faculty of Dentistry

Eur Oral Res 2020; 54(3): 123-129

Original research

Quality of communicating design features for cobalt chromium removable partial dentures in Riyadh, Saudi Arabia

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Purpose
This survey aimed to investigate quality of communicating design features for the construction of cobalt chromium removable partial dentures (RPDs) among dentists in Riyadh, Saudi Arabia.

Materials and Methods
A survey of nine commercial dental laboratories located in Riyadh was carried out. In each visit, master casts for cobalt chromium RPDs and dentists' prescriptions were examined. A quality score for the provided instructions was developed and ranged from 0 to 4. A zero score means that no instructions were sent from the dentist for the design of the RPD. A score of 4 means that instructions were provided for the design of four main elements of the RPD, i.e., shape of major connector, type of direct retainers, position of direct retainers, position of dental rests.

Results
162 dentists' prescriptions for RPDs and related casts were assessed. The majority of RPD cases were designed by the dental technician alone (64.2%). Shape of the major connector was the most frequent element in dentists' prescriptions (35.8%). The mean quality score of dentists' instructions was 0.96 (sd=1.54). 18% of the provided instructions achieved quality score equal to 4. Prescriptions for Kennedy Class III cases achieved significantly higher mean quality score compared to Kennedy Class II cases ($p<0.05$). 16.7% of the evaluated casts had clearly defined rest seat preparation.

Conclusion
The results of this survey indicate inadequate quality of communicating the design features of cobalt chromium RPDs among practicing dentists in Riyadh, Saudi Arabia. The reliance on the dental technician to design the cast RPDs seems to be high.

Keywords: *Quality; Design; Cobalt chromium; Removable; Partial dentures; Saudi Arabia*

Introduction

Although tooth/implant-supported fixed dental restorations are usually more preferred for the restoration of edentulous spaces, the removable partial denture (RPD) remains a viable treatment option for the replacement of missing teeth in partially edentulous mouths (1). This is mainly related to economic and technical factors (2). The RPD is, relatively, a conservative, simple and inexpensive type of treatment. It does not require high clinical or technical skills nor advanced technologies compared to implant-supported prostheses (3). Moreover, it is a reversible treatment option so in case of denture failure or patient's dissatisfaction a dentist in agreement with the patient can switch to tooth/implant-supported fixed dental restorations to restore the dental spaces. In addition, the RPD can be the single restoration option when various contraindications preclude the use of tooth/implant-supported fixed dental restorations (4). Furthermore, the findings of epidemiologi-

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Received: 09 October 2019
Revised: 20 January 2020
Accepted: 14 April 2020

DOI: 10.26650/eor.20200117

How to cite: *Nassani MZ, AlOtaibi MS. Quality of communicating design features for cobalt chromium removable partial dentures in Riyadh, Saudi Arabia. Eur Oral Res 2020; 54(3): 123-129.*

cal studies support the speculations of continuing demand for the RPDs in the upcoming future (5-10). Current adult dental health surveys have shown growing trend of retaining teeth later in life than ever before (5-7). The proportion of completely edentulous patients is in decline and the number of partially edentulous patients is in raise (8, 9). This comes in line with an increasing number of the elderly populations who are in need for dental and prosthodontic care (10).

In Saudi Arabia, the available epidemiological data cannot provide clear view regarding prevalence of partial edentulism and the need for RPD treatment on a national level. However, the existing evidence suggests that the proportion of partially edentulous subjects among the Saudi population is considerable and the need for treatment with RPDs should not be underestimated (11-16).

An essential step in the construction of the RPD is to evaluate the status of the oral and dental supporting structures and to plan the design features of the denture based on the clinical and radiological findings. Afterwards and following mouth preparation final impressions should be made. At this stage the dentist has to communicate the design features of the planned RPD to the dental technician so as to fabricate a prosthesis that has the potential to function in harmony with the soft and hard oral structures without causing damage to the surrounding/underlying tissues. Careful design of the RPD and writing adequate prescription pave the way for a successful outcome of treatment with RPDs. Such professional behavior is also a mark of standard care and quality practice (17). This issue was stressed by many international dental associations and health authorities. According to the Medical Devices Directive of the European Union (18) and the guidelines of the British Society for the Study of Prosthetic Dentistry (19), it is the responsibility of the dentist to design the RPD and to provide the dental technician with clear written instructions for the fabrication of the prosthesis. Provision of a standard dental care should be an inherent part of modern dental education and contemporary dental practice. Dental practitioners worldwide should recognize the ethical and legal implications of malpractice and its negative impact on oral health and patient's well-being. While quality of communicating design elements of RPDs has been investigated in many countries worldwide (20-29), the picture is not yet clear in Saudi Arabia. The aim of this survey is to investigate the quality of prescription and communicating design features for the fabrication of cobalt chromium RPDs among dentists in Riyadh, Saudi Arabia.

Materials and Methods

Twelve commercial dental laboratories located in Riyadh city, the capital of Saudi Arabia, were contacted and invited to take part in this survey. Two laboratories declined participation; one laboratory apologized due to lack of facility to construct cobalt chromium RPDs and 9 laboratories approved to participate. The geographical location of participating laboratories comprised the different sectors of Riyadh. Five laboratories were in the northern sector and one in each of the remaining sectors of Riyadh, i.e., east, west, middle and south. Five laboratories provide work for both private and governmental dental centers/hospitals and 4 laboratories provide work for only the private dental sector.

The nine participating commercial dental laboratories were surveyed over a period of more than 6 months. The aim of the survey was to target partially edentulous cases that were sent from dentists working in Riyadh for the fabrication of clasp-retained cobalt chromium RPDs. Arrangements were made with the designated laboratories to keep records for the all constructed RPDs and frequent visits were made by the second author to examine the collected cases. During each visit dentists' prescriptions were scrutinized, targeted casts were examined and a special data collection form was completed. The data collection form was a modified version of the one that was used in a previous investigation (30). Before the outset of the survey, the developed form was also distributed among 6 dental technicians to provide feedback about the clarity and feasibility of the contents. The noted remarks were considered in the final draft of the research form.

The study form sought information relating to:

- Laboratory address and location in Riyadh.
- Dental center address and location in Riyadh.
- Type of practice (governmental or private).
- Type of the examined cast (maxillary or mandibular).
- Kennedy classification (Class I, Class II, Class III and Class IV).
- Number of standing teeth.
- Number of dental spaces.
- Who made the RPD design? (the dentist alone, the technician alone, both the dentist and the technician).
- Methods of communicating the RPD design (verbal instructions, written instructions, diagram, drawing on the cast, none).
- Whether the design features of each component of the RPD was provided by the dentist (i.e. major connectors, direct retainers and rests)?
- Type of the major connector as provided by the dentist.
- Evidence of preparation of rest seats.

Prescriptions were examined following the fabrication of the metal framework. This is to ensure that no further design instructions could be provided by the dentist and one could be certain that no relevant information was missed. Photographs and digital records were made for the examined cases. When needed, dental technicians at the designated laboratories were consulted to clarify any confusing points upon scrutinizing dentists' prescriptions and associated casts. Both authors discussed and agreed the collected data.

Statistical analysis

Survey data were analyzed using the SPSS statistical package (IBM SPSS Statistics for Windows, Version 20.0, Released 2011, IBM Corp, Armonk, New York, USA). Descriptive statistics presented the characteristics of the examined cases and frequency tables were generated to illustrate the used methods for communicating design features of the prescribed RPDs as provided by the dentists. Also, a frequency table was made to demonstrate the quality of rest seat preparation among the surveyed cases.

In order to quantify the quality of instructions for the RPD design as provided by the dentist to the dental technician, a quality score was developed. The quality score was calculated according to the number of prescribed design elements as shown in Table 1.

Table 1. *Quality score of the provided instructions according to number of prescribed design elements of the RPD*

Number of prescribed elements	Quality score
None	0
Any one	1
Any two	2
Any three	3
All four	4

Quality scores: 0 = No instructions were provided by the dentist for the design of any element of the RPD. 1, 2 or 3= One, two or three elements of the RPD was/were prescribed by the dentist. 4 = Instructions were provided by the dentist for the design of the four main elements of the RPD, i.e. shape of the major connector, type of the direct retainer, position of the direct retainer, and position of the dental rests.

The quality scores were presented according to type of cast and Kennedy classification. T-test for independent samples and the one-way ANOVA were utilized to examine the association between mean score of the quality of the provided instructions and type of cast/Kennedy classification. The significance level was set at $p < 0.05$.

Results

Over the period of this survey, a total of 162 dentists' prescriptions for RPDs and associated casts were examined. The collected cases came from a variety of dental centers that were located in the different geographical areas of Riyadh city. The vast majority of the surveyed cases came from the private sector (92.6%). Number of mandibular casts slightly exceeded that of maxillary ones (52.5% compared to 47.5%). Kennedy Class I cases were the most frequent (53.7%) and Kennedy Class IV cases were the least frequent (3%). Characteristics of the examined cases are presented in Table 2.

Examination of dentists' prescriptions and related casts showed that most of the RPD cases were designed by the dental technician alone (64.2%). In these cases, the dentists did not send any instructions about the design of the requested RPD. Only 16% of the RPDs were designed by the dentist alone. The dentist and dental technician shared the design of the partial denture in almost 20% of the examined cases. Methods of communicating the design of RPD varied between dentists. Almost 12% of the dentists provided verbal instructions, a minority sent written instructions (8.6%) and 5.6% provided a diagram about the proposed design of the RPD. The design of the denture was drawn on the cast in 10% of the cases. Shape of the major connector was indicated by the dentist in 58 cases (35.8%). Type and position of the direct retainers were determined in about 20% of the cases and denture rests were prescribed by the dentist in 21% of the examined casts and prescriptions. The former results are illustrated in Table 3.

The mean quality score of dentists' instructions was approximately 1. Only 18% of the provided instructions achieved quality score equal to 4. The quality score was 0 among the majority of the examined cases (64.2%) and in 18% of the cases the quality score ranged between 1 and 3 indicating insufficient instructions for the design of RPD. No association was identified between type of cast, i.e. maxillary or mandibular, and quality scores of the instructions ($p>0.05$). On the contrary, an association was found between Kennedy classification of the restored dentition and quality

Table 2. *Characteristics of the examined cases (No = 162)*

Variable		Number	Percent
Laboratory location in Riyadh	***North***	86	53.1
	South	1	0.6
	Centre	19	11.7
	West	28	17.3
	East	28	17.3
Practice location in Riyadh	***North***	39	24.1
	South	3	1.9
	Centre	10	6.2
	West	28	17.3
	East	82	50.6
Type of practice	***Governmental***	12	7.4
	Private	150	92.6
Type of cast	***Maxillary***	77	47.5
	Mandibular	85	52.5
Kennedy classification	***Class I***	87	53.7
	Class II	44	27.2
	Class III	26	16
	Class IV	5	3.1
		Mean	**SD**
Number of standing teeth		7.7	3
Number of edentulous dental spaces		2.1	0.7

Table 3. *Methods of communicating RPD design and design features as provided by the dentist*

RPD design			
		Number	**Percent**
Who made the design?	***The dentist alone***	26	16
	The technician alone	104	64.2
	Both dentist and technician	32	19.8
Methods of communicating RPD design	***Verbal instructions (via phone or face to face)***	19	11.7
	Written instructions	14	8.6
	Diagram	9	5.6
	Drawing on the cast	16	9.9
	None	104	64.2
Design features as provided by the dentist			
Shape of major connector		58	35.8
Direct retainers	***Type***	31	19.1
	Position	32	19.8
Rests		34	21

Total number of the examined cases = 162, RPD: Removable partial denture

scores of the provided instructions as Kennedy Class III cases achieved significantly higher mean quality score compared to Kennedy Class II cases ($p<0.05$) (Table 4).

When a major connector was prescribed by the dentist, the horseshoe design followed by the palatal plate design, were the most prescribed connectors for the maxillary RPDs. On the other hand, the lingual bar and lingual plate designs were the dominant connectors for the mandibular RPDs (Table 5).

The working casts of the RPDs were examined for an evidence of rest seats preparation. The results indicated that rest seat preparation was unpopular practice as only 16.7% of the evaluated casts had clearly defined rest seat preparation (Table 6).

Discussion

Research to investigate quality of current dental practice on an international level is still limited (17). Extensive research to underline the status of today's dental practice and development of guidelines for quality dental care is highly recommended. In Saudi Arabia, over the last three decades there has been wide expansion in dental education and growing number of dental graduates (31). This was coupled with rapid growth in the delivery of oral health services (32-33). Despite these facts, information about quality of present dental care in Saudi Arabia is quite scarce. So far, only few attempts have been made to address this important issue (34-35). While this study evaluates the quality of communicating design features for RPDs, it can be considered a starting point and call for researcher to investigate the standard of current dental services in Saudi Arabia on all levels. This is in order to achieve a national goal of standard dental care for all people.

The RPD is one of the prosthodontic treatment options for the replacement of missing teeth. Although RPDs have their limitations and contraindications, the RPDs have also certain advantages and indications (4, 36). General dental practitioners worldwide are still expected to possess the required clinical skills to offer their patients such simple treatment option. The superiority and attractiveness of tooth/implant-supported

Table 4. *Quality of instructions for RPD design according to type of cast and Kennedy classification*

Quality Score	Type of Cast		Kennedy Classification				Total
	Maxillary	Mandibular	Class I	Class II	Class III	Class IV	
0	52(67.5%)	52(61.2%)	53(61%)	35(79.5%)	14(53.8%)	2(40%)	104(64.2%)
1	9(11.7%)	13(15.3%)	16(18.4%)	4(9.1%)	0(0%)	2(40%)	22(13.6%)
2	1(1.3%)	3(3.5%)	3(3.4%)	0(0%)	1(3.8%)	0(0%)	4(2.5%)
3	2(2.6%)	1(1.2%)	3(3.4%)	0(0%)	0(0%)	0(0%)	3(1.9%)
4	13(16.9%)	16(18.8%)	12(13.8%)	5(11.4%)	11(42.4)	1(20%)	29(17.9%)
Total	77(100%)	85(100%)	87(100%)	44(100%)	26(100%)	5(100%)	162(100%)
Mean (SD)	0.9(1.53)	1.01(1.56)	0.91(1.43)	0.55(1.28)	1.77(1.99)	1.2(1.64)	0.96(1.54)
p	*0.634			**0.013			--

** p-value of the t-test for independent samples indicating no significant difference (p>0.05). ** p-value of the one-way ANOVA indicating significant difference at p<0.05.* **Quality scores:** 0 = No instructions were provided by the dentist for the design of any element of the RPD. 1, 2 or 3= One, two or three elements of the RPD was/were prescribed by the dentist. 4 = Instructions were provided by the dentist for the design of the four main elements of the RPD, i.e. shape of the major connector, type of the direct retainer, position of the direct retainer, and position of the dental rests.

Table 5. *Major connectors as provided by the dentist*

Upper major connector	Number	Percent
Palatal plate	7	9.1
U-shaped or horseshoe	10	12.9
Anterior and posterior palatal bars	2	2.7
Anterior and posterior palatal strap	4	5.2
Single Palatal strap	1	1.3
Single palatal bar	0	0
Dentist did not design any major connector	53	68.8
Total number of examined maxillary casts	77	100
Lower major connector		
Lingual plate	10	11.8
Lingual bar	24	28.2
Sublingual bar	0	0
Double lingual bar	0	0
Cingulum bar	0	0
Labial bar	0	0
Dentist did not design any major connector	51	60
Total number of examined mandibular casts	85	100

Total number of the examined cases = 162 (77 *Maxillary casts and* 85 *Mandibular)*

Table 6. *Rest seats preparation (information derived from the master casts)*

Availability of rest seat preparation	Number	Percent
Cast with clearly defined rest seats preparation	27	16.7
Cast with no rest seats preparation	124	76.5
Cast with rest seats that are difficult to ascertain whether they have been prepared	8	4.9
Cast is not available	3	1.9

fixed partial dentures do not justify low interest in learning the topic of RPDs or poor management of this treatment modality. Principles of construction RPDs should be respected to maximize the chance of success and any negligence on this part is, professionally and ethically, not accepted.

In a survey of commercial dental labs in Athens, Greece (37), the constructed RPDs were mostly for Kennedy Class I dentitions. In a recent Saudi study for the prevalence of missing teeth and type of provided prosthetic treatment (16), most of the patients with Kennedy class I or class II were treated with RPDs. In this survey, characteristics of the examined cases reveal clear predominance for Kennedy Class I and Class II in the study sample (Table 2). It appears that the higher need/demand for treatment with RPDs is associated with the presence of free-end saddles or missing posterior support.

Overall, the results indicate poor quality of communicating design features for RPDs among dentists in Riyadh, Saudi Arabia. This is consistent with the findings of previous international studies (24, 27, 28, 38-40). The quality scores of the provided instructions for RPD design were very low among the majority of the examined cases (Table 4). The reliance on dental technicians to perform the design of the RPD seems huge. This means a production of RPDs with no account to the clinical and biological findings. The final likely outcome, could be, a provision of faulty dentures with damaging effect and poor prognosis. This is clearly a mark of malpractice (17). In the UK and Ireland, the poor quality of written instructions for the design of cobalt chromium RPDs was attributed to educational factors (41). Major problems in teaching the design and construction of cobalt chromium RPDs during the vocational training of dental graduates were identified (41). Dental educators in Saudi Arabia should take the results of this survey into account when planning dental curricula and prosthodontic courses of continuing professional development. Further research, perhaps of qualitative nature, is warranted to understand the reasons behind such inappropriate professional behavior among practicing dentists in Riyadh, Saudi Arabia.

In an Irish survey (39), the authors used very similar criteria to that used in our survey to quantify the level of prescription for cobalt chromium RPDs. Four design variables were scrutinized in dentists' written instructions (39). These include: configuration of denture base, retention (design of clasps, material and position), support (position and distribution of rests), and design of the major connector. The four design variables were found in 10% of the examined written instructions. In 7% of the prescriptions there were three design variables, in 13% two design variables were found, in 17% one design variable was identified and 53% of the prescriptions were lacking any design variables (39). In the current survey the aforementioned figures are compared to 17.9%, 1.9%, 2.5%, 13.6% and 64.2% respectively (Table 4).

While no relation was established between quality of the provided instructions and type of dental cast for the treated case, an association was determined between Kennedy classification and quality of prescription (Table 4). The reliance of the surveyed dentists on the technicians to design cases with Kennedy Class II appears to be greater than the other Kennedy Classes. An explanation for this finding cannot be provided and it is recommended to search this point in future studies.

In this investigation, the design of cobalt chromium RPDs was delegated entirely to the dental technician in 64.2% of the examined cases. This number is compared to 57% in the neighboring Kingdom of Bahrain (23) and 89.5% in the United Arab Emirates (26). However, this comparison cannot be claimed to be accurate as the examined samples for cobalt chromium RPDs in Bahrain and UAE were very small (n =14 and 19 respectively). In an earlier study in Saudi Arabia, a self-administered questionnaire was used to collect information about quality of written instructions in the work authorization form and the level of communication between dentists and dental technicians for fixed and removable prosthodontics (34). Data was obtained from dental technicians working in the Dental College at King Saud University. The results indicated that 49.6% of the examined written instructions were judged as clear and in 34% of the fixed and removable cases the dental technician had to communicate with the dentist to obtain more clarification regarding certain written instructions. With RPDs, the author reported that the design was made by the dentist in 95% of the evaluated work authorization. However, all these cases were made in a University environment by a specialist, a demonstrator, a postgraduate student, an intern or a dental student. As the design of that survey was different from the design of our survey, no valid comparison can be made between their findings.

Using a diagram or a drawing on the cast to communicate the design of the RPD seems to be uncommon method of communication among dentists in Riyadh, Saudi Arabia (Table 3). This also was the case in Ireland as only 7% of the dentists provided a diagram in their prescriptions for cobalt chromium RPDs (39). In the Kingdom of Bahrain, the proportion of dentists who provided a diagram in their prescriptions for the cobalt chromium RPDs was 43% (23). This is compared to 5.6% in the current survey. In the UAE, 36.85% of the dentists sometimes use a drawing for the RPD design and 63.2% never/rarely do that (26). In this survey, 10% of the dentists communicated the design of the RPD through a drawing on the cast. It should be remembered again that the number of the examined cases in Bahrain and UAE was very small and the validity of any comparison with the results of this survey can be questioned.

Table 3 illustrates that when instructions were provided, the shape of the major connector was the most frequent element to be prescribed by the surveyed dentists (35.8%). This is similar to the outcome of a UK survey where the design of the major connector was the most common component in dentists' prescriptions (59%) (30). The reason why dentists in this survey give more attention to the design of the major connector in comparison with the other elements of the cobalt chromium RPDs is not clear.

Despite the shortcomings of the horseshoe connector in terms of flexibility and wide coverage of dental and gingival tissues, this design of a major connector was the most prescribed for the maxillary RPDs (Table 5). This is in agreement with the results of a Greek survey (37). Unfortunately; the design of this study does not allow us to identify the reasons behind such practice. In the mandible, only two types of major connectors were noted in dentists' prescriptions. These comprise the lingual bar and lingual plate. Similarly, these types of mandibular major connectors were found to be popular among dentists in the UK (30, 38, 42). The biological and hygienic merits of the lingual bar are well-known

to practitioners (38). Although the lingual plate is the most rigid mandibular connector, it may encourage plaque accumulation and risk the health of the supporting dental and gingival tissues (43). However, the lingual plate is well tolerated by a majority of patients and may contribute to indirect retention of the RPD (38, 44).

The dependence of the surveyed dentists on the dental technician to design the direct retainers of the RPD is alarming. Prescription of the type and position of the denture clasps was recorded in almost 20% of the cases (Table 3). This is compared to 47.7% in an Iranian survey (28).

Preparation of rest seats is an essential part of mouth rehabilitation to receive a metal RPD. Adequate rest seat preparation is important for denture support and effective indirect retention. Nonetheless, the results of this survey underline poor practice with respect to rest seat preparation. Evidence of rest seat preparation was missing in the majority of the examined master casts (Table 6). In the UAE survey (26), rest seat preparation was identified in 13 out of the 19 assessed cast RPD cases (68.4%). However, such small sample may not reflect the current practice among UAE dentists in this respect. In the UK, Nassani et al., (30) reported that preparation of rest seats was encountered in 23% of the studied RPD cases and Rice et al., (45) recognized rest seat preparation in 30% of the assessed casts for cobalt chromium RPDs.

A limitation for this survey is related to the surveyed dental laboratories. The choice of the laboratories was on the basis of practicality and availability of facilities for the fabrication of cobalt chromium RPDs. However, an account was made for the participation of laboratories from the different sectors of Riyadh.

It can be noted that the surveyed cases present a random sample of the constructed RPDs in Riyadh city and were included in the study due to their presence in the participating laboratory at the time of the study. Moreover, the examined cases in this survey came from the different geographical areas of Riyadh and probably present the current practice of general dental practitioners working in Riyadh with regard to communicating design features of cobalt chromium RPDs. However, the results cannot necessarily be generalized to the whole Kingdom of Saudi Arabia. Nevertheless, Riyadh city is the capital of the Kingdom. It hosts the largest turnover of medical and dental services across the country (32). Hence, one could argue that the outcome of this survey provide considerable insight on the current status of prescription for the construction of metal RPDs among dentists working in Saudi Arabia. A future national survey is recommended to confirm the findings.

Conclusion

The final outcome of this survey indicates poor quality of communicating the design features of cobalt chromium RPDs among practicing dentists in Riyadh, Saudi Arabia. The reliance on the dental technician to perform the design of the cast RPDs seems to be high. This finding is a sign of malpractice with ethical, legal and clinical implications. Further research, perhaps of qualitative nature, is recommended to understand the reasons behind such inappropriate professional behavior.

Türkçe Özet: *Suudi Arabistan Riyad'da kobalt krom hareketli parsiyel protezlerin dizayn özelliklerinin yaylaşılma kalitesi. Amaç: Bu araştırmada, kobalt krom hareketli parsiyel protezlerin (HPP) dizayn özelliklerinin Suudi Arabistan Riyad'daki diş hekimleri arasında paylaşılmasının incelenmesi amaçlanmıştır. Gereç ve Yöntem: Riyad'daki dokuz ticari dental laboratuvar araştırılmıştır. Her ziyarette, kobalt krom HPP için hazırlanmış ana modeler ve diş hekimlerinin yönergeleri incelenmiştir. Belirtilen yönergelerin kalite skoru 0-4 arasında notlanmıştır. Sıfır skor diş hekiminden laboratuvara hiçbir yönerge gelmediği anlamına gelmektedir. Skor 4 ise ana bağlayıcının şekli, direk tutucu elemanların tipi, direk tutucuların poziyonu ve tırnakların yeri gibi HPP'nin ana elemanlarının dizaynı için talimatlar verildiği anlamına gelmektedir. Bulgular: 162 diş hekimi talimatı ve ilgili modeler incelenmiştir. Vakaların büyük çoğunluğunun diş teknisyenleri tarafından planlandığı tespit edilmiştir (%64,2). Diş hekimlerinin talimatlarında en sık olarak ana bağlayıcı şekli belirtilmiştir (%35,8). Diş hekimlerinin kalite sokr ortalaması 0,96'dır (SS=1,54). Talimatların %18'inde 4 skoru belirlenmiştir. Kennedy Sınıf III vakalarda, Kennedy Sınıf II vakalara oranla daha yüksek kalite skorlarına rastlanmıştır ($p<0.05$). İncelenen modellerin %16,7'si açıkça tırnak yeri hazırlamayı belşrtmiştir. Sonuç: Bu araştırmanın bulguları Suudi Arabistan Riyad'da kobalt krom HPP dizayn özelliklerinin paylaşılmasında yetersiz bir kalite göstermektedir. Diş teknisyenlerinin HPP modeler üzerinde yaptıkları planlamalara olan güven büyüktür. Anahtar kelimeler: Kalite, dizayn, kobalt krom, hareketli, parsiyel protezler, Suudi Arabistan*

Ethics Committee Approval: Not required.

Informed Consent: The informed consents were provided by the participants.

Peer-review: Externally peer-reviewed.

Author contributions: MZN and MSA designed the study. MZN and MSA participated in generating the data for the study. MSA participated in gathering the data for the study and MZN participated in the analysis of the data. MZN wrote the majority of the original draft of the paper. MSA participated in writing the paper. All authors approved the final version of this paper.

Conflict of Interest: The authors had no conflict of interest to declare.

Financial Disclosure: The authors declared that they have received no financial support.

Acknowledgements: The authors would like to express their deep gratitude to the managers and staff of the surveyed dental laboratories for their invaluable assistance over the period of this survey. Many thanks and gratitude for the Deanship of Graduate Studies and Scientific Research at Dar Al Uloom University for the assistance in publication of this research.

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