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RESEARCH ARTICLE

Removable Partial Denture Design in Dental Practice: Epidemiological Study in The Region of Rabat-Sale-Kenitra (Part 3)

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ABSTRACT

Introduction

Despite the enrichment of our therapeutic panoply by integrating implants and CAD/CAM techniques, the removable partial denture with metallic infrastructure (RPD) will remain an unavoidable alternative in the rehabilitation of partial edentulous teeth. The purpose of this survey, divided into three parts, is to evaluate the knowledge, attitudes, and practices of dentists in private practice in the Rabat-Sale-Kenitra region regarding the design of removable partial dentures, to provide information on the means of communication with laboratory technicians, and to investigate possible correlations between the failure of the prosthetic project and certain adopted practices.

Materials and methods

The study concerned a sample of 101 dentists practicing in the region of Rabat-Sale-Kenitra to whom we sent an anonymous 4-page printed questionnaire containing 28 questions on the design of metal frames in PAPM. A descriptive and analytical statistical study was conducted to process the data.

Results

Following the results of the statistical study, only 8% of the practitioners performed more than ten partial removable prostheses per month, 17% did not perform a clinical examination, 20% did not perform a study model, 69% did not perform the RPD design by themselves and entrusted this task to the dental technician. In comparison, 89% did not use a Dental Surveyor.

Conclusion

This survey showed that many practitioners do not follow the rules of good practice and that they lack knowledge of RPD design. Therefore, postgraduate training is envisaged to eventually help practitioners implement these good practices and improve this knowledge. However, it was noted that only 58% of the practitioners in our sample were interested in such training.

KEYWORDS: Removable Partial Denture; Design-partial edentulous.

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INTRODUCTION

For anatomical, medical, or economic reasons, the removable partial denture (RPD) is the ideal treatment for many patients to rehabilitate aesthetically and functionally a partial edentulism. **[1]**

The long-term success of this kind of rehabilitation depends on the adoption of the principles of design and realization of the framework guided by the mechanical, biological, and aesthetic requirements and a close collaboration based on perfect communication between the clinician and the laboratory technician **[2] [3]**

The reflection on the biomechanical constraints undergone by the prosthesis and the mastery of the theoretical design corresponding to the different classes of edentulous allow deducing a reasoned design that will be transferred to the laboratory to realize the framework**. [4]**

Compared to the luxury of fixed prosthesis and implantology, which provide an irreproachable aesthetic and comfort, the removable partial metal prosthesis is too often judged as a minor practice and thus underestimated in the training of the practitioner who, as a result, entrusts most often the design stage to his prosthesis. **[1] [2] [5]**

Thus, whether the design method is conventional or computer-assisted, performing the RPD design is a crucial step in prosthetic rehabilitation that should not be underestimated and delegated to the prosthetist who

cannot establish a diagnosis under the clinical situation and the patient's expectations. **[6]**
The mains of this descriptive and analytical cross-sectional study conducted in private practices in the Rabat-Sale-Kenitra region is to evaluate the habits of the dentist and the quality of communication with the laboratory in terms of the metal framework design.

MATERIALS AND METHODS

The survey conducted is cross-sectional, descriptive, and analytical conducted among general dentists practicing in the private sector in the Rabat-Sale-Kenitra region who are on the official list of the Order of Dentists. The survey period was from 23/09/2019 to 29/11/2019.
The study included general dentists practicing in the private sector in the Rabat-Sale-Kenitra region and listed in the official list of the Order of Dentists. Dentists practicing an exclusive specialty were excluded from the sample.
A questionnaire was formulated to collect in its first part personal and professional data. The rest of the questionnaire concerned the clinicians' practices to develop an RPDM design.
We used two types of questionnaires: the first on paper and the second digital via Google Forms. We were able to collect 101 responses.
- The software "Statistical Package for Social Science (SPSS) version 13.0" was used for the statistical analysis and Microsoft Office Excel 2016 for the realization of the graphs
- The tests used were: the Chi-square test or Fisher's exact test. The difference is considered statistically significant when the p-value is less than 0.05.
- Multinomial logistic regression was used to search for explanatory factors of prosthetic failure.

DESCRIPTIVE RESULTS

General characteristics of the sample

We began our investigation by the practitioners' personal information, including gender, age, experience, college of study, and place and mode of practice. First, the results obtained showed no predominance of one sex over the other. The difference was only 2% in favor of the female sex. Regarding age, the majority of the practitioners were young doctors, with 62% aged between 25 and 40 years, the youngest was 25 years old while the oldest was 72 years old.
Most of the dentists interviewed obtained their diplomas in Morocco. The remaining 43% graduated from foreign faculties.
The distribution of practitioners according to their experience showed that 59% had been practicing for less than ten years, 26% for between 10 and 20 years, and 15% for more than 20 years.

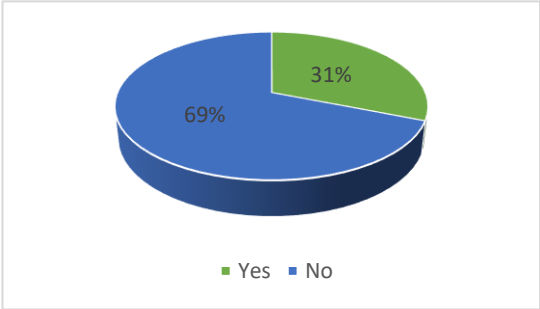
Information on metal framework design practices

To find out the percentage of practitioners who carry out the design of the PDR themselves and to assess the communication quality between the clinician and the laboratory technician, we included the following questions in the questionnaire (Graph 6).
Only 31% of the practitioners questioned drew the framework themselves. For this first case, we had 3 cases of figures:
The majority of the practitioners traced the framework on the study model (48%). The remainder was done directly with the prosthetist in the office (36%) or on a paper (16%).
Half of the practitioners who said no to the previous question trusted their prosthetists, the rest was set by rules with their prosthetists according to the classes (31%), or they asked for a frame design on the study model (19%)
Then we request the practitioners in which cases they tended to modify their framework design and what these modifications were. Five practitioners did not answer this question. The others tend to make modifications in case of
- Weakened periodontium (62%).
- RPDM with root attachment (20%).
- Implant-stabilized metal partial denture (18%).

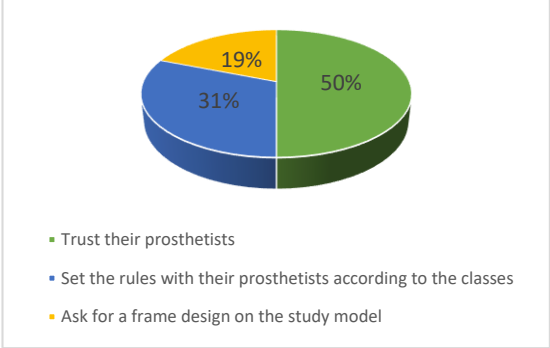
Regarding the modifications to be made, except for 11 practitioners who did not answer this question, the results were:
- Remove the clasp completely (43%).
- Remove the retentive part of the clasp (26%).
- Remove the cingular bar (17%).
- Use of Anterior-Posterior Palatal Strap (14%).

Practitioner interest in computer-assisted frame design training:
We wanted to know if the practitioners were interested in this training
58% of dentists are interested in this training.
42% of them were not.

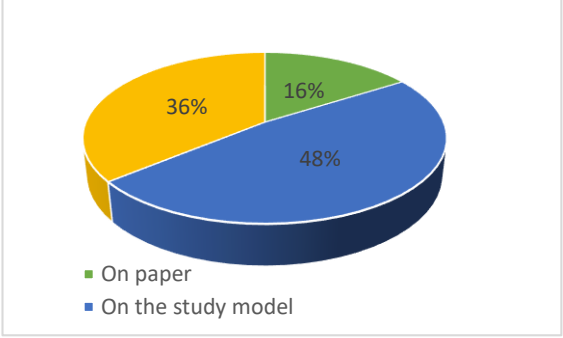
Graph 1: Percentage of practitioners who perform RPD design themselves



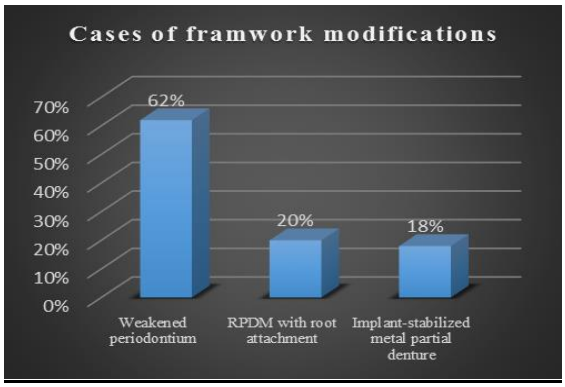
Graph 2: Practitioners who do not perform the RPD design themselves



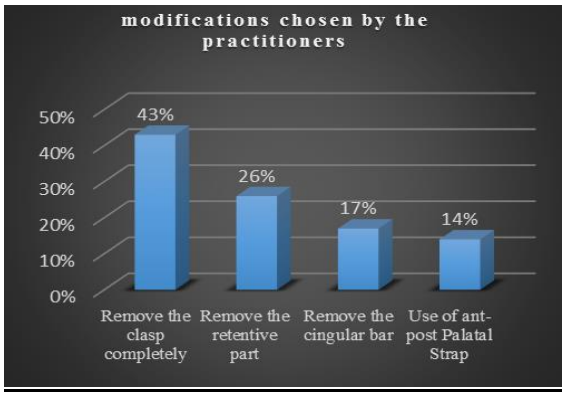
Graph 3: means used to transfer the RPD design to the prosthetist



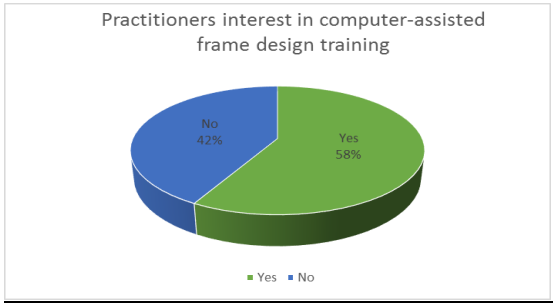
Graph 4: Cases in which practitioners modify the design



Graph 5: Modifications chosen by the practitioners



Graph 6: practitioners interested in CAD/CAM training



ANALYTICAL RESULTS

This study shows that 70% of men do not perform the design. The same effect was observed with women (69%). These results are statistically not significant (p=0.986).

We found that the percentage of practitioners not performing the design was high among those with 10-20 years of experience (89%), whereas less experienced practitioners (1-10 years) took the trouble to perform the RPD design themselves in a statistically significant way (p=0.046). 65% of the practitioners surveyed who studied in Morocco did not perform a procedure compared to 68% of those who studied abroad, which was statistically significant (p=0.030).

70% of urban practitioners do not perform the design compared to 67% of those working in suburban or rural areas, which was not statistically significant (p=0.81). **(Table 1)**

Correlation between performing or not of the RDP design and complaints

We note that practitioners who perform the RPD design themselves had fewer complaints associations (36%) than those who do not (73%). This difference is statistically significant (p=0.03) **(Table 2)**

Correlation between performing or not of the RDP design and practitioner knowledge

We were interested in the practitioners who made the RDP design themselves by analyzing the answers obtained in terms of gingiva spacing and type of clasps used in the bilateral distal edentulous

For the practitioners who perform the design themselves, 50% answered that the spacing should be 5 mm in the maxilla and 3 mm in the mandible. Only 32% answered 5 mm in the maxilla and 3 mm in the mandible for the practitioners who left this task to their dental technicians. This was statistically significant (p=0.024).

48% of the practitioners who did their design of the RDP responded that the clasp they recommended for use in the bilateral distal edentulous was the Back-Action clasp, compared to only 38% of the practitioners who did not do the RDP design. This is statistically significant (p=0.022). **(Table 3)**

Relationship between complaints and practitioner knowledge

We were interested in the relationship between the complaints and the practitioners' knowledge by analyzing the answers obtained in terms of gingiva spacing and the type of clasps used in the bilateral distal edentulous.

We note that 29% of the practitioners who encountered a combination of complaints answered that the spacing should be 5 mm in the maxilla and 3 mm in the mandible. The combination of complaints was found in 71% of the practitioners opting for other answers, and this is a statistically insignificant way (p=0.648).

We note that 40% of the practitioners who had a complaint association answered that the clasp they recommended for use in the bilateral distal edentulous was the Back-Action clasp, compared to 60% of practitioners who answered otherwise, and this is a statistically insignificant way (p=0.648). **(Table 4)**

Table 1: Relationship between experience and performing the RPD design

		performing the RPD design		p
		Yes	No	
Gender	Male	30 %	70%	0,986
	Woman	31%	69%	
Years of experience	Between 1 and 10 years	38%	62%	0,046*
	Between 10 and 20 years	11%	89%	
	Only 20 years left	33%	67%	
College	National	35%	65%	0,030*
	Foreign	32%	68%	
Place of practice	In town	30%	70%	0,81
	Sub-urban or Rural	33%	67%	

Table 2: Relationship between grievances and performing the RPD design

		Complaints				p
		Prosthetic instability	Retention problem	Appearance of wounds	Association	
performing the RPD design	Yes	0%	9%	55%	36%	0,03*
	No	6%	9%	12%	73%	

Table 3: Relationship between self-drawing the design and practitioner knowledge

		gingiva spacing		Clasp used in the bilateral distal edentulous	
		5 mm in the maxilla and 3 mm in the mandible	Other answers	Back-Action clasp	Other answers
performing the RPD design	YES	50%	50%	48%	52%
	NO	32%	68%	38%	62%
	p	0,024*		0,022*	

Table 4: Relationship between complaints and practitioner knowledge

		gingiva spacing		Clasp used in the bilateral distal edentulous	
		5 mm in the maxilla and 3 mm in the mandible	Other answers	Back-Action clasp	Other answers
Complaints	Appearance of wounds	40%	60%	58%	42%
	Prosthetic instability	34%	66%	52%	48%
	Retention problem	30%	70%	47%	53%
	Association	29%	71%	40%	60%
	p	0,648		0,821	

DISCUSSION

This study was conducted among dental practices in Rabat-Sale-Kenitra region to evaluate their involvement in designing the metal framework of the removable partial denture and the methods used to communicate this design to the laboratory.

The RPD design results from a thorough pre-prosthetic reflection based on a perfect clinical examination of the dento-periodontal and osteo-mucosal structures, completed by a radiographic assessment, an occlusal study, and an analysis of the diagnostic cast on a dental surveyor.

This reflection can only be done by the dental doctor who has received the patient, evaluated his general health, and identified his complaints and expectations.

The prospective plan is then sent to the laboratory technicians with the necessary explanations and the antagonist cast to begin the prosthetic realization, which depends on the quality of the communication between the clinician and the prosthetist.**[7]**

However, this study reports that only 31% of clinicians use the RDP design themselves, 48% use the study model to draw the design, 36% discuss directly with the dental technician, and 16% draw the design on paper.

The results show that 69% of the practitioners prefer to leave this task to their dental technicians, half of them trust them, the others establish rules with them according to the classes (31%), or they ask for a drawing of the design on the study model (19%)

The practitioners with the least years of practice (between 1 and 10 years) always performed the most RDP design with 38% against only 11% for those with 10 to 20 years of experience and 33% for those with over 20 years of experience.

Regarding the complaints, we noticed that the practitioners who did not perform the RPD design by themselves received their patients with two or more complaints in 73% of the cases against only 36% for the practitioners who draw their frameworks by themselves.

These results agree with those of previous studies conducted in this direction. **Kilfeather et al. (2009)** reported that of the written design instructions received by laboratories in Great Britain, only 30% were considered "clear," and 37% of study casts arrived without any design instructions. **[8] Nassani et al. (2010)** report that dentists provided a proposed design diagram in 29% of cases. **[9]**

Several studies have shown that the communication quality between the practitioner and the prosthetist, and therefore the performance of the prosthetic framework, did not meet the ethical and legal requirements.**[10]**

In a study conducted in **Bahrain in 2006**, the authors revealed that only 43% of the dentists provided a detailed chassis drawing to the dental technician. **[11]**

The same results were reported in a study made in **Dakar in 2020** in which **BADJI and al**. Report that 50% of the prosthetists do not receive the design with the working models, and the percentage of prosthetists who ask practitioners for more information on the type of clasp to

use is 54.5% and 45.5% for the path of insertion and guide planes. **[12]**
This is similar to what was reported in research studies conducted in **the UAE by HAJ ALI and Al in 2010**. They found that 63.2% never/rarely provide a design drawn. **[10]**
Another study conducted in **Toulouse** shows that 34% of the practitioners surveyed use the study model to draw the framework, and 35% use the model associated with written or dictated instructions over the phone. **[7]**
It should bear in mind that the lack of excellent communication between the clinician and the prosthetists can lead to poor quality designs and prostheses with serious consequences on the abutment teeth and ridges. **[11]**
This leads us to conclude that dentists have lost their basic knowledge of RDPs because they do not realize their design.
According to **the European Union Medical Device Guidelines**, the dental practitioner provides specific written instructions for the RPD design. The dental technician must produce the framework following these instructions. **[13]**
Scrutinizing results of the previous studies indicated that delegating the RDP design entirely to the dental technician is a common practice among a considerable proportion of dentists and requires further research to understand the reasons behind the continuity of these practices and to educate clinicians about the impact of inadequate RDP design or poor data transmission to the prosthetist **[9] [14]**
Although the prosthetist is an invaluable collaborator, he is unaware of the patient's expectations and does not have access to his relevant clinical information.
This practice may cause problems in the fit, retention, and overall comfort of the prosthesis, which is why practitioners need to be made more aware of their duties and responsibilities in this regard. **[8]**
A comparison of this study results shows that the majority of the practitioners who do their design had a good knowledge of gingiva spacing and clasps and answered our questions correctly, in contrast to the practitioners who entrusted this task to their prosthetists, the majority of whom answered incorrectly.
Indeed, 50% of the practitioners who perform the RDP design by themselves answered correctly to the question related to gingiva spacing against only 32% of the practitioners who do not draw the RDP design. The same is true for the question concerning the clasps, where 48% of the practitioners who perform the RDP design by themselves answered correctly against 38% of the practitioners who do not carry the RDP design.
It turns out that with age, dentists lose the basic notions and knowledge of designing DPRs, hence the need to set up a continuous training program to acquire new technologies and not feel outdated.
Like other areas of dentistry, the DPR has kept pace with the evolution of knowledge, scientific advances, techniques, and biomaterials in its design, clinical and laboratory procedures. The rise of Computer-Aided Design and Manufacturing (CAD/CAM) has changed the techniques of clinical data acquisition, design, and realization of RPD. Modeling software now facilitates the design of the prosthetic project. **[4] [15]**
Training in CAD/CAM is of interest to only 58% of practitioners. The Toulouse study showed a slightly higher percentage than ours, where 67% of practitioners were interested in this training. This shows the lack of concern of a significant number of dentists practicing in Morocco to improve their knowledge of removable prostheses compared to their colleagues practicing in France.
To keep up with the latest developments in the field, it will always be necessary to update its information and knowledge and invest more in continuing education under the penalty of losing possible gains. We believe that this is the case for most dentists in our sample.

CONCLUSION

The long-term success of the results depends on the adoption of the principles of design and realization of the framework guided by the mechanical, biological, and aesthetic requirements and a close collaboration based on excellent communication between the clinician and the laboratory technician.
Delegating PDR design entirely to the dental technician is a common practice among a considerable proportion of dentists. It requires further research to understand the reasons for this practice and educate clinicians about the consequences of inadequate PDR design or poor data transmission to the dental technician on patient health.
To improve the quality of patient care in terms of removable partial metal prostheses in the private sector, several actions can be taken:
On the part of the responsible organisms (Ministry of Health, National Council of the Order of Dentists of Morocco):

-Create a support program that accompanies young dentists in their post-graduate life and establishes good practices;

- Encourage dentists to invest more in continuing education;

Emphasize self-training and create practical guides through a computerized platform;
On the part of practitioners:

- Invest more in scientific congresses to update information and be open to new technologies.

- To work correctly and academically.

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AUTHORS' CONTRIBUTIONS
The participation of each author corresponds to the criteria of authorship and contributorship emphasized in the Recommendations for the Conduct, Reporting, Editing, and Publication of Scholarly work in Medical Journals of the International Committee of Medical Journal Editors. Indeed, all the authors have actively participated in the redaction, the revision of the manuscript, and provided approval for this final revised version.

COMPETING INTERESTS
The authors declare no competing interests with this case.

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